

# AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

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# TECHNICAL REPORT SUMMARIES

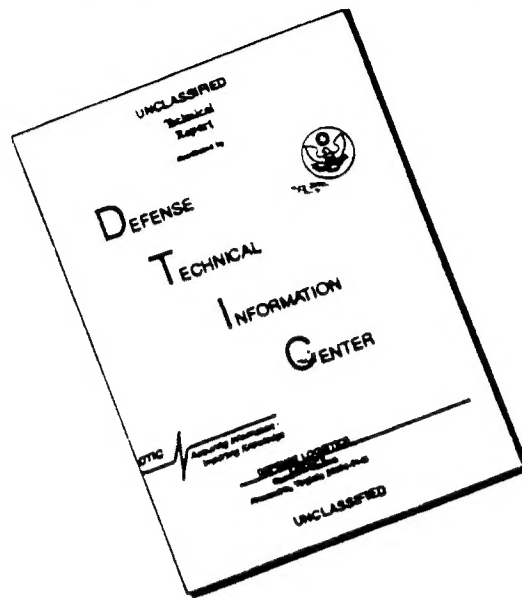


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**TECHNICAL REPORT SUMMARIES**

**SECOND QUARTER 1994**

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## INTRODUCTION

The Air Force Office of Scientific Research (AFOSR) Technical Report Summaries is published quarterly (March, June, September, and December). It contains a brief summary of each technical report received in the Technical Information Division and submitted to the Defense Technical Information Center (DTIC) for the quarter. Three indexes, subject, personal author and title are provided to help the user locate reports that may be of interest.

AFOSR does not maintain copies of technical reports for distribution. However, you may obtain any of these reports if you are registered with DTIC by requesting the AD number of that report from the DTIC, Cameron Station, Alexandria, Virginia, 22314.

## PURPOSE

The purpose of this report is to inform Air Force Laboratories about the science that the Air Force Office of Scientific Research is supporting.

## AFOSR MISSION

The Air Force Office of Scientific Research (AFOSR) is the single manager of the Air Force Defense Research Sciences Program (Program Element 61102F) and the primary Air Force agency for the extramural support of fundamental scientific research. To sponsor and sustain basic research and ensure access to research results in support of the Air Force goals of control and maximum utilization of air and space. The AFOSR is organized under the Director, Science and Technology, Air Force Materiel Command.

AFOSR awards grants and contracts for research in areas of science relevant to the needs of the Air Force. Research is selected for support from proposals received in response to the Broad Agency Announcement originating from scientists investigating problems involving the search for new knowledge and the expansion of scientific principles. Selection is on the basis of scientific potential for improving Air Force operational capabilities, originality, significance of science, the qualification of the principal investigators, and the reasonableness of the proposed budget.

## KEY TO READING THE DATA

The summaries consist of three indexes and the abstracts. From one of the indexes, located in the AD number of the report that is of interest to you. Use this number to locate the abstract of the report in the abstracts sections. The first report submitted to DTIC during the quarter (the one with the lowest AD number) appears on the last page of the abstracts section. The last report submitted to DTIC during the quarter (the one with the highest DTIC number) appears on the first page of the abstracts section. The following terms will give you a brief description of the elements used in each summary of this report.

DTIC Report Bibliography - DTIC's brief description of a technical report.

Search Control Number - A number assigned by DTIC at the time a bibliography is printed.

AD Number - A number assigned to each technical report when received by the DTIC.

Field & Group Numbers - (appearing after the AD number) First number is the subject field, and the second number is the particular group under that subject field.

Corporate Author/Performing Organization - The organization; e.g., college/university, company, etc., at which the research is conducted.

Title - The title of the technical report.

Descriptive Note - Gives the type of report; e.g., final, interim, etc., and the time period of the research.

Date - Date of the technical report.

Pages - Total number of pages contained in the technical report.

Personal Author - Person or persons who wrote the report.

Contract/Grant Number - The instrument control number identifying the contracting activity and funding year under which the research is initiated.

Project Number - A number unique to a particular area of science; e.g., 2304 is the project number for mathematics.

Task Number - An alphanumeric number unique to a specific field of the main area of science; e.g., 2304 is the project number for mathematics and A3 is the task number for computational sciences.

Monitor Number - The number assigned to a particular report by the government agency monitoring the research. The number consists of the government monitor acronym, the present calendar year and the technical report assigned consecutively; e.g., AFOSR-TR-93-0001 is the first number used for the first technical report processed for calendar year 1993.

Supplementary Note - A variety of statements pertaining to a report. For example, if the report is a journal article, the supplementary note might give you the journal citation, which will include the name of the journal that article it appears in, and the volume number, date and the page numbers of the journal.

Abstract - A brief summary describing the research of the report.

Descriptors - Key words describing the research.

Identifiers - Commonly used designators, such as names of equipment, names of projects or acronyms, the AFOSR project and task number, and the Air Force Research Program Element number.

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BROWN UNIV PROVIDENCE RI METCALF CHEMICAL LABS

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Distribution authorized to DoD only; Critical Technology; 29 Apr 94. Other requests shall be referred to Air Force Office of Scientific Research, Bolling AFB, DC 20332.

ABSTRACT: (U) Macrophages are essential in wound healing. They are one of the first cells to enter the wound, where the oxygen tension is 0-10 mmHg. Although we were unable to find any reference in the literature, it is generally believed that this hypoxia attracts the macrophages to the wound center. We have proposed that oxygen tension will directly or indirectly influence macrophage migration. To evaluate this hypothesis, we have three objectives.

DESCRIPTORS: (U) \*CHEMOTHERAPEUTIC AGENTS, \*OXYGEN, MACROPHAGES, DRUGS, WOUNDS AND INJURIES, HEALING, HYPOXIA, MIGRATION, CELLS(BIOLOGY).

IDENTIFIERS: (U) WUAFOSR2312CS, PEB1102F.

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AD-B183 384L

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AD-B183 136L 6/1 6/4 5/8 AD-B183 134L 9/5 20/6 7/6  
 PRINCETON UNIV NJ TACAN CORP CARLSBAD CA  
 (U) Physiological Analyses of the Afferents Controlling  
 Brain Neurochemical Systems.  
 DESCRIPTIVE NOTE: Technical rept. 1 Jun 92-30 Nov 93,  
 MAR 94 3P  
 PERSONAL AUTHORS: Jacobs, Barry L.  
 CONTRACT NO. AFOSR-90-0294  
 PROJECT NO. 2312  
 TASK NO. BS  
 MONITOR: AFOSR, XC  
 TR-94-0172, AFOSR

AD-B183 134L 9/5 20/6 7/6  
 TACAN CORP CARLSBAD CA  
 (U) High Speed Electro-Optic Modulators.  
 DESCRIPTIVE NOTE: Final technical rept. 15 Jul 93-14 Jan  
 94,  
 MAR 94 42P  
 PERSONAL AUTHORS: Bechtel, James H.  
 CONTRACT NO. F49620-93-C-0032  
 PROJECT NO. 3005  
 TASK NO. SS  
 MONITOR: AFOSR, XC  
 TR-94-0153, AFOSR

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Distribution authorized to DoD only; Critical Technology;  
 21 Mar 94. Other requests shall be referred to AFOSR/NL,  
 Bolling AFB, DC 20332.

Distribution authorized to DoD only; Proprietary Info.;  
 18 Mar 94. Other requests shall be referred to Air Force  
 Office of Scientific Research, Bolling AFB, DC 20332-0001.

ABSTRACT: (U) Experiments have focussed on utilizing  
 extracellular single unit recordings in combination with  
 multibarrel microiontophoresis. The issues explored are  
 how brain neurochemical systems, such as serotonin and  
 norepinephrine, modulate functional activity in target  
 brain structures. Brain, Chemical neurotransmission,  
 Physiology and serotonin, Norepinephrine

ABSTRACT: (U) During this work, materials, devices and  
 architectures for high speed E-O modulators have been  
 studied for nonlinear optical polymer. An integrated Mach-  
 Zehnder interferometer is identified as the most  
 efficient device architecture. We found that for the same  
 nonlinearity and the same electrode length and bandwidth,  
 the required RF modulation powers are in a ratio of 1 : 2.  
 25 : 3 (respectively) for a Mach-Zehnder interferometer,  
 a birefringent modulator, and a directional coupler to  
 achieve a 100% modulation depth. The desired material  
 properties are discussed and summarized. Using the  
 product of the half-wave voltage and modulation length V  
 L as a figure-of-merit, we find that an effective E-O  
 coefficient in the range of 36-54 pm/V is required to  
 achieve the same state-of-art LiNbO3 device performance.  
 We have surveyed the published data of the second-order  
 nonlinear optical polymers to identify the candidates for  
 high speed polymeric modulators. For practical device  
 fabrication, materials with large nonlinearity and high  
 thermal stability are discussed in detail. We also  
 participated in new nonlinear optical material  
 characterization and evaluation in collaboration with

DESCRIPTORS: (U) \*BRAIN, \*CONTROL, \*NEUROCHEMISTRY,  
 CHEMICALS, NOREPINEPHRINE, PHYSIOLOGY, SEROTONIN,  
 STRUCTURES, TARGETS, ANIMALS, ATTENTION, BEHAVIOR,  
 FUNCTIONS, INFORMATION PROCESSING, NERVE CELLS, SLEEP.

IDENTIFIERS: (U) PEB1102F, WUAFOSR2312BS.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-B183 134L CONTINUED

other research institutions. Several NLO polymer and sol-gel systems were characterized. An integrated Mach-Zehnder interferometer modulator for Phase II research has been designed with an 1s of expected performances.

DESCRIPTORS: (U) \*ELECTROOPTICS, \*MODULATORS, \*OPTICAL MATERIALS, BANDWIDTH, COUPLERS, DEPTH, HIGH VELOCITY, DIRECTIONAL, ELECTRODES, FABRICATION, FIGURE OF MERIT, NONLINEAR OPTICS, RADIOFREQUENCY, INTERFEROMETERS, LENGTH, MODULATION, BIREFRINGENCE, LITHIUM NIOBATES, POLYMERS, SINGLE CRYSTALS, THIN FILMS, OPTICAL WAVEGUIDES, THERMAL STABILITY, VELOCITY, VOLTAGE.

IDENTIFIERS: (U) PEGE502F, WUAFOSR3005SS, Sol-gels.

AD-B182 972 1/4 12/5

BARRON ASSOCIATES INC STANARDSVILLE VA

(U) Self-Designing Flight Control Using Modified Sequential Least Squares Parameter Estimation and Optimal Receding Horizon Control Laws.

DESCRIPTIVE NOTE: Final technical rept. 15 Jul 93-14 Mar 94,

MAR 94 104P

PERSONAL AUTHORS: Ward, David G.; Barron, Roger L.

REPORT NO. 173-FTR

CONTRACT NO. F49620-93-C-0044

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-0155, AFOSR

UNCLASSIFIED REPORT  
EXPORT CONTROL

Distribution authorized to U.S. Gov't. agencies and their contractors; Specific Authority; 14 Mar 94. Other requests shall be referred to AFOSR, Bolling AFB, Washington, DC 20332-0001. This document contains export-controlled technical data.

ABSTRACT: (U) A study has been performed of self-designing flight control based upon modified sequential least squares (MSLS) parameter identification and analytically-derived low-gain adaptive optimal receding horizon control laws. The simulation results obtained indicate that this type of control system performs well under nominal conditions and in the presence of unmodeled dynamics, air turbulence, extreme values of sensor noise, and severe control effector and airframe impairments. Parameter identification experiments conducted using a nonlinear time-varying six-degree-of-freedom simulation of the F-16/MATV aircraft suggest that standard recursive least squares/Kalman estimation techniques do not adequately track the airframe and effector parameters, high-variations that can occur during severe impairments, high-angle-of-attack maneuvers, and post-stall flight regimes.

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Substantial improvement vis-a-vis standard techniques was observed with the MSLS parameter estimation algorithm. Self-designing control, Receding horizon control, Adaptive control, Optimum control, Two-point boundary-value control, Nonlinear, Time-varying systems.

DESCRIPTORS: (U) \*FLIGHT SIMULATION, \*LINEAR SYSTEMS, \*FLIGHT CONTROL SYSTEMS, \*SYSTEMS ENGINEERING, AIRCRAFT, AIRFRAMES, ALGORITHMS, BOUNDARIES, CONTROL SYSTEMS, DYNAMICS, FLIGHT, GAIN, HIGH ANGLES, HORIZON, IDENTIFICATION, MANEUVERS, NOISE, PARAMETERS, STANDARDS, TIME, TRACKS, TURBULENCE, VALUE, VARIATIONS, ADAPTIVE CONTROL SYSTEMS, LEAST SQUARES METHOD, COMPUTERIZED SIMULATION, ANGLE OF ATTACK, STALLING.

IDENTIFIERS: (U) PEG9502F, WUAFOSR3005SS, EXPORT CONTROL, MSLS(Modified Sequential Least Squares), F-16 Aircraft.

AD-B182 968L 7/4 11/4 20/5 20/2

CRYSTALLUME MENLO PARK CA

(U) CVD Diamond Doped with Transition Metals and Rare Earths for Persistent Spectral Hole Burning Memory Applications.

DESCRIPTIVE NOTE: Final rept. 15 Jun 93-14 Feb 94,

FEB 94 29P

PERSONAL AUTHORS: Phillips, William

CONTRACT NO. F49620-93-C-0031

MONITOR: AFOSR, XC  
TR-94-0189, AFOSR

UNCLASSIFIED REPORT  
EXPORT CONTROL

Distribution authorized to U.S. Gov't. agencies only; Proprietary Info.; Feb 94. Other requests shall be referred to AFOSR/PKI, Bolling AFB, DC 20332-0001. This document contains export-controlled technical data.

ABSTRACT: (U) In this investigation we attempted to determine if CVD diamond is a suitable host material in which to incorporate transition metal (TM) or rare earth (RE) elements in order to create a useful spectral hole burning memory material. Diamond is potentially important in this application because it supports color centers exhibiting intrinsically narrow zero phonon lines which are inhomogeneously broadened and capable of persistent spectral hole burning (PSHB) at relatively high temperatures. We developed procedures for producing transition metal or rare earth metal vapor within a microwave plasma CVD reactor and demonstrated that it transports simultaneously with diamond film growth. Concentrations of TM or RE incorporated in the diamond films were below the detection limit of energy dispersive x-ray or of SIMS analysis. Samples examined by Professor Choyke at the University of Pittsburgh by low temperature cathodoluminescence exhibit emission from color centers which have apparently been stabilized at high concentrations by the unique growth process. The doping process may be useful for stabilizing selective concentrations of color centers, or for incorporating more soluble ions such as Si or Li in diamond films. Spectral hole burning, Transition metal, Rare earth

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element, Color center, CVD diamond.

LASER PHOTONICS TECHNOLOGY INC AMHERST NY

DESCRIPTORS: (U) \*COLOR CENTERS, \*DIAMONDS, \*DOPING, \*RARE EARTH ELEMENTS, \*TRANSITION METALS, \*CHEMICAL VAPOR DEPOSITION, CATHODOLUMINESCENCE, DETECTION, EMISSION, ENERGY, FILMS, HIGH TEMPERATURE, IONS, LOW TEMPERATURE, MATERIALS, METAL VAPORS, MICROWAVES, PHONONS, SILICON, TEMPERATURE, TRANSPORT SHIPS, X RAYS, MEMORY DEVICES, HOMOGENEITY, COLLISION BROADENING, PLASMAS(PHYSICS), LITHIUM.

(U) A New Class of Novel Nonlinear Optical Materials for Second Order Applications.

DESCRIPTIVE NOTE: Final rept. 15 Jul 93-15 Jan 94,

MAR 94 38P

PERSONAL AUTHORS: Zhang, Yue; Ghosal, Saswati; He, Guang; Burzynski, Ryszard

IDENTIFIERS: (U) EXPORT CONTROL, \*Spectral hole burning, Energy dispersive, \*Inhomogenously.

REPORT NO. LPT-AF5FR-1

CONTRACT NO. F49620-93-C-0054

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-0183, AFOSR

UNCLASSIFIED REPORT

Distribution authorized to U.S. Gov't. agencies only; Proprietary Info.; 21 Apr 94. Other requests shall be referred to Air Force Office of Scientific Research, 110 Duncan Ave., Ste B115, Bolling AFB, Washington, DC 20332-0001.

ABSTRACT: (U) A novel class of second order nonlinear optical (SONLO) materials has been developed and been shown to have many practical applications. A series of polymers and ORMOSILs have been synthesized which contain nonlinear optical chromophores which can be rapidly and very effectively aligned under an electric field to yield noncentrosymmetric films at room temperature. These materials are in contrast to more conventional approaches which attempt to prepare SONLO materials by fixing the alignment of the chromophores at high temperatures. In the absence of an external field, all materials face dipolar relaxation at some rate which is further enhanced at higher temperatures. The presence of the applied field assures that the nonlinear optical properties will be retained. The synthesis and optical properties of these novel materials are described in this report. The materials have excellent mechanical and optical

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characteristics and demonstrate the requisite nonlinear optical properties. The materials are discussed in terms of their potential to be used in beam steering devices, phase matched second harmonic generators and as electrooptic modulators. These materials are suggested for use in the fabrication of high frequency (GHz) electrooptic modulators. Second order nonlinear optics, polymer, ORMOSIL, Electrooptic modulator, Low Tg materials

DESCRIPTORS: (U) \*BEAM STEERING, \*NONLINEAR OPTICS, \*OPTICAL MATERIALS, ALIGNMENT, APPROACH, CHROMOPHORES, CONTRAST, ELECTRIC FIELDS, ELECTROOPTICS, EXTERNAL, FABRICATION, FILMS, FREQUENCY, GENERATORS, HARMONIC GENERATORS, HARMONICS, HIGH FREQUENCY, HIGH TEMPERATURE, MATERIALS, MODULATORS, NONLINEAR OPTICS, OPTICAL PROPERTIES, OPTICS, PHASE, POLYMERS, RATES, RELAXATION, ROOM TEMPERATURE, STEERING, SYNTHESIS, TEMPERATURE, YIELD, MILITARY APPLICATIONS, PHOTONICS.

IDENTIFIERS: (U) WUAFOSR3005SS, SBIR (Small Business Innovative Research) Program, Chromophores.

AD-B182 410L 9/1

PARKVIEW RESEARCH AND DEVELOPMENT INC MADISON WI  
(U) HTS Circuits Based on Nonlinear Transmission Lines.  
DESCRIPTIVE NOTE: Final technical rept. no 3, 1 Jul-31 Dec 93,  
FEB 93 38P

PERSONAL AUTHORS: Hohenwarter, Gert K.; Hromadka, Nancy  
CONTRACT NO. F49620-93-C-0024  
MONITOR: AFOSR, XA  
TR-94-0133, AFOSR

UNCLASSIFIED REPORT

Distribution: Further dissemination only as directed by AFOSR/NE, Building 410, Washington, DC 20332-6448.

DESCRIPTORS: (U) \*SPACE COMMUNICATIONS, \*TRANSMISSION LINES, \*SUPERCONDUCTIVITY, BOUNDARIES, CIRCUITS, CRYSTALS, ELECTRONICS, FILMS, GRAIN BOUNDARIES, INSTRUMENTATION, LAYERS, MICROWAVES, PROTOTYPES, RECEIVERS, SINGLE CRYSTALS, SUPERCONDUCTORS, TERMINALS, THIN FILMS.

IDENTIFIERS: (U) \*Terrestrial communications

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AD-A280 516 20/3 7/4

## NZ APPLIED TECHNOLOGIES CAMBRIDGE MA

## MISSOURI UNIV-COLUMBIA DEPT OF PHYSICS

(U) Novel Method for Growth of P/N Type Epitaxial GaN for High Temperature Electronic Device Applications.

(U) Microscopic Theory of the Dielectric Response of Highly Dispersive Biological Media.

DESCRIPTIVE NOTE: Final rept. 15 Jul 93-14 Jan 94,

DESCRIPTIVE NOTE: Final rept. 1 May 91-31 Jan 94,

JAN 94 27P

JAN 94 5P

PERSONAL AUTHORS: Norris, Peter E.

PERSONAL AUTHORS: Vignale, Giovanni

REPORT NO. NTZ0003,

CONTRACT NO. AFOSR-91-0203

PROJECT NO. 3005

PROJECT NO. 2304

TASK NO. SS

TASK NO. A4

MONITOR: AFOSR, XC

MONITOR: AFOSR, XC  
TR-94-0349, AFOSR

TR-94-0080, AFOSR

UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

Distribution: Further dissemination only as directed by Air Force Office of Scientific Research; Boiling AFB, DC 20332-0001, 28 Jan 94 or higher DoD authority.

DESCRIPTORS: (U) \*ELECTRONICS, \*EPITAXIAL GROWTH, \*HIGH DENSITY, \*GALLIUM, \*NITRIDES, \*CHEMICAL VAPOR DEPOSITION, \*LIGHT EMITTING DIODES, BLUE(COLOR), CHEMICALS, CONDUCTIVITY, DENSITY, DEPOSITION, EMISSION, FILMS, HALL EFFECT, HIGH TEMPERATURE, LOW TEMPERATURE, MATERIALS, MEASUREMENT, NONLINEAR OPTICS, PERIODIC VARIATIONS, PHASE, PHOTOLUMINESCENCE, QUALITY, SEMICONDUCTORS, STORAGE, SUBSTRATES, TEMPERATURE, X RAYS, FIELD EFFECT TRANSISTORS, INFORMATION SYSTEMS, PLASMAS(PHYSICS), AUGMENTATION, COMPOSITE MATERIALS, DOPING.

IDENTIFIERS: (U) WUAFOSR3005SS, PE65502F, PECVD(Plasma Enhanced Chemical Vapor Deposition), Metalorganic, Optoelectronic devices, Widedgap, MOCVD, P/N.

ABSTRACT: (U) The researchers formulated a theory to describe and calculate the dynamical dielectric response of classical interacting molecular liquids in terms of their corresponding static response functions. There are two basic ideas in this approach. One idea is to use a local effective field to take into account the long range coherent effects of the molecular interactions. These local fields are derived from the static structural properties of the liquid. The other idea to calculate the self-part of the Van Hove correlation function from the solution of a Boltzmann transport equation in phase space in a number conserving relaxation time approximation. This smoothly interpolates between the hydrodynamic and free particle regimes. Thus they obtained an important generalization of previous theories of molecular liquids, which only treated the self-part of the van Hove correlation function in the hydrodynamic limit, that is  $w=0$  and  $q=0$ .

DESCRIPTORS: (U) \*DIELECTRICS, \*HYDROSTATIC PRESSURE, APPROACH, BOLTZMANN EQUATION, CORRELATION, EQUATIONS, FUNCTIONS, HYDRODYNAMICS, INTERACTIONS, LIQUIDS, NUMBERS, PARTICLES, PHASE, RELAXATION TIME, RESPONSE, STATICS, STRUCTURAL PROPERTIES, THEORY, TIME, TRANSPORT, VANS, MICROSCOPY, CONDUCTION BANDS, HIGH PRESSURE.

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IDENTIFIERS: (U) WUAFOSR2304A4, PE61102F.

MARYLAND UNIV COLLEGE PARK

(U) A Fundamental Study of Hypersonic Unstarts.

DESCRIPTIVE NOTE: Final rept. 1 Oct 91-30 Sep 93,

MAY 94 65P

PERSONAL AUTHORS: Lewis, Mark J.

CONTRACT NO. F49620-92-J-0006 16

PROJECT NO. 2307

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0362, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Activities for the first year were primarily focused on laying the groundwork for accomplishing the ultimate goals of this investigation. Required hardware and software was obtained and implemented. Grid generators were tested and one was selected, as was the primary computational tool. Activities in the second year were directed towards beginning the three dimensional Euler, then Navier-Stokes calculations, to establish a steady-state time accurate baseline, which could then be perturbed to study the influence of downstream disturbances. Both Euler and laminar Navier-Stokes solutions were calculated. Hypersonic, Inlet, Unstart.

DESCRIPTORS: (U) \*HYPERSONIC FLOW, \*JET ENGINE INLETS, \*COMBUSTION, GENERATORS, GRIDS, STEADY STATE, EULER EQUATIONS, NAVIER STOKES EQUATIONS, FLOW FIELDS, SHOCK TUBES, BOUNDARY LAYER CONTROL, THREE DIMENSIONAL, FLOW SEPARATION, COMPUTATIONS, VELOCITY, TEMPERATURE GRADIENTS, DENSITY.

IDENTIFIERS: (U) WUAFOSR2307AS.

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CALIFORNIA UNIV SANTA BARBARA DEPT OF ELECTRICAL AND  
COMPUTER ENGINEERING

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22/1

PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF  
AEROSPACE ENGINEERING

(U) Solving Ill-Conditioned Matrix Equations in Control.

DESCRIPTIVE NOTE: Final technical rept. 15 Jun 91-14 Oct  
93,

MAY 94

10P

PERSONAL AUTHORS: Jacobs, Marc Q.

REPORT NO. UCSB-TR-1

CONTRACT NO. AFOSR-91-0240

MONITOR: AFOSR, XC  
TR-94-0360, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The primary objective of this grant has been the study of algorithms for solving ill-conditioned matrix equations arising in control, filtering, and system theory. Much of our work has concentrated on matrix Riccati and Lyapunov equations which are absolutely fundamental to the field. We have made significant advances on a number of fronts in the numerical solution of large-scale and ill-conditioned Lyapunov, Sylvester, and Riccati equations. Substantial progress has been made in other areas as well, including a new family of algorithms based on matrix interpolation for frequency response and related problems, a number of key advances in numerical linear algebra, algorithms for infinite-dimensional systems, a new theory of small sample statistical condition estimation, and software implementations of many of our algorithms. Our results have been reported in over thirty scholarly articles. Computational control, Matrix equations, Numerical linear algebra, Ill conditioning.

DESCRIPTORS: (U) \*ALGORITHMS, \*MATHEMATICAL PROGRAMMING, \*MATRICES(MATHEMATICS), \*CONTROL THEORY, LARGE SCALE INTERPOLATION, COMPUTATIONS, FREQUENCY RESPONSE, INTERPOLATION, LINEAR ALGEBRA, RICCATI EQUATION, LYAPUNOV FUNCTIONS, NUMERICAL INTEGRATION, CONTROL SYSTEMS.

IDENTIFIERS: (U) Ill conditioning.

AD-A280 502

(U) Configurational Evolution Dynamics and Stability During In-Situ Development of Large Orbiting Spacecraft.

DESCRIPTIVE NOTE: Final technical rept. 15 Jan 91-14 Jan 94,

APR 94

51P

PERSONAL AUTHORS: Amos, Anthony K.

CONTRACT NO. AFOSR-91-0155

MONITOR: AFOSR, XC  
TR-94-0361, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report documents the objectives, major tasks and approaches of the research project, and the progress made over the three year span of the effort. The primary objective is presented as being the search for understanding of and analytical simulation capability for the effects of flexibility and configuration evolution on the on-orbit dynamics and stability of orbiting spacecraft. The approach is described in terms of the modeling and analysis of isolated deployment and assembly mechanisms, the modeling and analysis of coupled orbital-attitude-vibration dynamics of orbiting spacecraft, and the integration of the two for on-orbit system performance simulation. Details of the modeling and analysis efforts are described and sample results obtained during the course of the research are presented and discussed. Configuration evolution, On-orbit dynamics, Stability of spacecraft.

DESCRIPTORS: (U) \*CONFIGURATIONS, \*ORBITS, \*SIMULATION, \*SPACECRAFT, ASSEMBLY, DEPLOYMENT, DOCUMENTS, DYNAMICS, INTEGRATION, STABILITY, VIBRATION.

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VIRGINIA POLYTECHNIC INST AND STATE UNIV BLACKSBURG DEPT  
OF ENGINEERING SCIEN CE AND MECHANICS

ANTENNAS, ROBOTICS, CERAMIC MATERIALS, CONTROL SYSTEMS,  
MODELS, PIEZOELECTRIC MATERIALS, DAMPING, STRATEGY,  
STRUCTURES, SUPPRESSION, TANGENTS, THRUST, SOLAR CELLS,  
FRAMES, UNCERTAINTY, VELOCITY, VIBRATION, STRUCTURAL  
COMPONENTS.

(U) Modeling and Control of Intelligent Flexible  
Structures.

DESCRIPTIVE NOTE: Final rept. 15 Jun 90-14 Dec 93,

IDENTIFIERS: (U) \*Smart structures.

MAR 94 207P

PERSONAL AUTHORS: Inman, Daniel J.

CONTRACT NO. AFOSR-91-0181

MONITOR: AFOSR, XC  
TR-94-0353, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The research effort reported here summarizes the issues and discoveries of a three year effort to examine the modeling and control of intelligent structures for aerospace applications. Intelligent structures or smart structures or more appropriately, active structures are defined here in a narrow sense as structures with highly integrated sensors and actuators (piezoceramic elements in this case). The major control thrust is vibration suppression. The issues of interest are (a) is the complexity of a smart structure control system worth it, (b) how detailed must modeling be to produce effective results, and (c) does the choice of a control law make a significant difference on the response. The results show clearly that improved models and complex control strategies form the most effective combination. The results show three experimental examples which clearly indicate the usefulness and advantages of smart structures over conventional vibration suppression methodologies. In particular, active structures improve overall efficiency in cases involving both flexible and rigid body control. In addition, some tangent results on nonlinear control, control in the presence of uncertainties and control of thermoelastic systems are presented. Smart intelligent structure, Slewing, solar arrays, Antenna, Structural control, Nonlinear controller, Thermoelastic response, Critical speed control.

DESCRIPTORS: (U) \*ARTIFICIAL INTELLIGENCE, \*AEROSPACE CRAFT, \*SLEWING, \*STRUCTURAL RESPONSE, ACTUATORS.

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LOUISIANA STATE UNIV MEDICAL CENTER SHREVEPORT

(U) Cerebral Neurochemical Mechanisms in Stress and Anxiety.

DESCRIPTIVE NOTE: Annual technical rept. 1 Feb 93-31 Jan 94,

FEB 94 44P

PERSONAL AUTHORS: Dunn, Adrian J.; Swiergiel, Artur H.

CONTRACT NO. F49620-93-1-0125

PROJECT NO. 2312

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0366, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Investigations are concerned with the cerebral mechanisms involved in stress. Current experiments focused on the locus coeruleus noradrenergic (LC-NE) system. In vivo microdialysis studies showed that both hemodynamic stress induced by nitroprusside, and electric footshock increased the apparent release of norepinephrine (NE) in the hypothalamus and prefrontal cortex. The potential role of corticotropin-releasing factor (CRF) in the activation of the LC-NE system was investigated. CRF infused into the LC, but not in surrounding brain structures (such as the par nucleus), increased the apparent synaptic release of cortical NE. This effect was largely ungenderal, and to involve CRF-receptors. We have performed preliminary studies using the new technique of in vivo voltammetry. These studies have confirmed the increased appearance of extracellular NE following nitroprusside infusion. The superior time resolution of this technique indicated that the NE response nitroprusside was short-lived. The classic benzodiazepine anxiolytic, chlorazepoxide (CDP), appeared to diminish the NE response to footshock and may also affect basal NE release. Behavioral studies indicated that activation of NE system with idazoxan almost completely inhibited stress-induced ultrasonic vocalization, with relatively small changes in stress-

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Induced freezing. We failed to find any consistent effects of 6-hydroxydopamine-induced lesions of the dorsal noradrenergic bundle, although vocalization was slightly potentiated. Stress, Anxiety, Norepinephrine microdialysis, Benzodiazepine, Voltammetry, Behavior

DESCRIPTORS: (U) \*ANXIETY, \*NOREPINEPHRINE, \*STRESS(PHYSIOLOGY), \*STRESS(PSYCHOLOGY), \*PERFORMANCE(HUMAN), ACTIVATION, BEHAVIOR, BRAIN, BUNDLES, FREEZING, HYPOTHALAMUS, INFUSIONS, LESIONS, LOCUS, RELEASE, RESOLUTION, RESPONSE, STRUCTURES, TIME, ULTRASONICS, VOLTAMMETRY, IN VIVO ANALYSIS, PHYSIOLOGICAL EFFECTS, RESPONSE(BIOLOGY).

IDENTIFIERS: (U) PEB1102F, WUAFOSR2312BS, Microdialysis.

## UNCLASSIFIED

DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A280 487 8/4

AD-A280 466 8/4

TEXAS A AND M UNIV COLLEGE STATION DEPT OF BIOLOGY

FLORIDA STATE UNIV TALLAHASSEE

(U) Melatonin, the Pineal Gland, and Circadian Rhythms.

(U) Electrophysiological and Ionic Properties of Intrinsic Circadian Pacemakers in the Vertebrate Pineal Gland.

DESCRIPTIVE NOTE: Annual rept. 1 Mar 93-28 Feb 94,

DESCRIPTIVE NOTE: Annual technical rept. 1 Apr 93-31 Mar 94,

FEB 94 6P

PERSONAL AUTHORS: Cassone, Vincent M.

MAY 94 7P

CONTRACT NO. AFOSR-90-0244

PERSONAL AUTHORS: Dryer, Stuart E.

PROJECT NO. 2312

CONTRACT NO. F49620-93-1-0303

TASK NO. CS

PROJECT NO. 2312

MONITOR: AFOSR, XC

TASK NO. CS

TR-94-0358, AFOSR

MONITOR: AFOSR, XC  
TR-94-0358, AFOSR

UNCLASSIFIED REPORT

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ABSTRACT: (U) Pineal melatonin may effect the light sensitivity of rats such that, pineal ectomized rats perceive ambient intensity to be higher than sham-operated controls. We have tested this a several ways. Essentially, we can find no evidence that pinealectomized rats are more sensitive to light than are pinealectomized rats. We have found that free-running circadian period lengthens in response to increasing light intensities at the same rate, but that pinealectomized rats become disrupted at lower intensities than do sham-operated animals. Further, our initial observation that enucleation of rats abolishes SCN iodomelatonin binding has proven incorrect when we corrected for circadian phase. Pineal melatonin influences circadian system coupling either at the level of coupling among circadian oscillators themselves or between these oscillators and there multiple outputs.

DESCRIPTORS: (U) \*MELATONIN, \*CIRCADIAN RHYTHMS, \*PINEAL GLAND, ANIMALS, CONTROL, COUPLINGS, INTENSITY, LIGHT, OBSERVATION, OSCILLATORS, OUTPUT, PHASE, RATES, RATS, RESPONSE, SENSITIVITY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312CS.

ABSTRACT: (U) Cyclic GMP-activated channels of the chick pineal gland are not altered by physiological concentrations of cytoplasmic  $Ca^{2+}$  ions. They are partially blocked by physiological levels of  $Mg^{2+}$ . Changes in intracellular pH over a range of 6.2-8.2 do not affect the gating of these channels. Chick pineal cells exhibit spontaneous oscillations in intracellular free  $Ca^{2+}$  and can mobilize intracellular  $Ca^{2+}$  stores. Agents that increase intracellular cyclic AMP cause increases in intracellular  $Ca^{2+}$ . Similar effects are caused by VIP but not norepinephrine. Depletion of intracellular stores causes release of a message that promotes influx of  $Ca^{2+}$  from the outside. Internal stores of  $Ca^{2+}$  represent a potential target for the intrinsic circadian oscillator. Inhibition of phosphodiesterases cause activation of cyclic GMP-activated channels in the whole pineal cell, suggesting that photo-transduction cascades similar to those of the vertebrate retina are also present in chick pineal cells. A second large-conductance cation channel has also been detected and may play a role in spontaneous or drug-induced  $Ca^{2+}$  oscillations

DESCRIPTORS: (U) \*PINEAL GLAND, \*VERTEBRATES, ACTIVATION, CATIONS, CELLS, CHANNELS, DEPLETION, DRUGS, GLANDS,

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INHIBITION, INTERNAL, IONS, NOREPINEPHRINE, OSCILLATION,  
OSCILLATORS, RECREATION, RELEASE, RETINA, STORES, TARGETS,  
ELECTROPHYSIOLOGY, HORMONES.

WISCONSIN UNIV-MADISON DEPT OF ELECTRICAL AND COMPUTER  
ENGINEERING

(U) Basic Studies in Plasma Wave Interactions.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312CS.

DESCRIPTIVE NOTE: Final rept. 1 May 89-30 Apr 94,

MAY 94 40P

PERSONAL AUTHORS: Scharer, J. E.

CONTRACT NO. AFOSR-89-0353

PROJECT NO. 2301

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0368, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Research on microwave propagation, reflection, absorption and backscatter in XUV excimer laser (193 run) and microwave (2.45 GHz) produced plasmas has been carried out. Our research on high density, low temperature  $n(e) = 5 \times 10^{13}/\text{cm}^3$ , 1 eV laser-created plasma and broadband (1-3 GHz) microwave transmission, absorption and backscatter between two antennas in a plasma are described. Research on the creation of a laser produced sheet beam plasma for either a low loss, rapidly scanable agile microwave mirror reflector (10 GHz) or a diffuse, lossy absorber is being carried out. Measurements and theoretical analysis of these topics are described. We also discuss our collaborations with other research groups and our theoretical and computational research to support and interpret the experimental observations.

DESCRIPTORS: (U) \*PLASMA WAVES, \*LASER BEAMS, \*MICROWAVE TRANSMISSION, ABSORPTION, EXCIMER, BACKSCATTERING, ULTRAVIOLET RADIATION, HIGH DENSITY, LOW TEMPERATURE, BROADBAND ANTENNAS, WAVE PROPAGATION, IONIZED GASES, OPTICAL DETECTION, CYCLOTRON RESONANCE, REFLECTION, REFLECTORS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2301ES, XUV(Extreme Ultraviolet).

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CALIFORNIA UNIV SAN DIEGO LA JOLLA DEPT OF MATHEMATICS  
(U) H Infinity Control for Nonlinear and Linear Systems.

DESCRIPTIVE NOTE: Final technical rept. 1 Apr 91-31 Mar 94,

MAR 94 17P

PERSONAL AUTHORS: Helton, J. W.

CONTRACT NO. AFOSR-91-0166

PROJECT NO. 2304

TASK NO. A1

MONITOR: AFOSR, XC  
TR-94-0359, AFOSR

## UNCLASSIFIED REPORT

**ABSTRACT:** (U) The design of a system or circuit in which stability is a key constraint frequently leads to an optimization problem over the space of functions analytic on the right half plane (R.H.P.) Mathematical techniques for solving such optimization problems for mean square error (L2 error) criteria have been widespread in engineering since the time of Wiener. Much of this research goes to developing techniques for handling worst case error (L infinity error) criteria. These occur naturally in design of control systems and amplifiers. Practically speaking there is evidence that frequency domain L infinity criteria control system designs have desirable robustness properties. The ultimate objective is to develop a new CAD approach to MIMO control design which has the flavor of classical control as well as a systematic approach to worst case frequency domain design as it occurs in many areas. The promise of this approach is sufficient to have attracted many investigators and it is currently the focus of much attention. This research addresses many aspects of the problem. They range from the development of computer algorithms of a radically different type to the discovery of theoretical methods for understanding computational design. Also considerable progress was made in extending existing H infinity control to nonlinear plants. Another major effort involves computer algebra for systems research. The

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objective is to treat (on a computer) systems formulas of the type an investigator would manipulate by hand. Considerable software was developed along these lines.

DESCRIPTORS: (U) \*COMPUTER PROGRAMS, \*CONTROL SYSTEMS, ALGORITHMS, AMPLIFIERS, ERROR ANALYSIS, NONLINEAR SYSTEMS, CIRCUITS, CONTROL THEORY, FEEDBACK, DESIGN CRITERIA.

IDENTIFIERS: (U) Mathematica programming language.

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK

MATERIALS, MONOMERS, FIBERS, IMPLANTATION, CHEMICAL VAPOR DEPOSITION, VITREOUS STATE, BORANES.

(U) Basic Solutions to Carbon/Carbon Oxidation: Science and Technology.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484CS,  
\*PAN(Polyacrylonitrile), Vinylcatecholborane,  
\*PBD(Polybutadiene), 1, 4-polybutadienes, Polydiyne,  
SAF(Special Acrylic Fibers).

DESCRIPTIVE NOTE: Annual technical rept. 15 Apr 93-14 Apr 94,

MAY 94 49P

PERSONAL AUTHORS: Harrison, Tan R.; Chung, T-C; Radovic, Ljubisa; Pantano, Carlo; Thrower, Peter A.

CONTRACT NO. F49620-93-1-0311

PROJECT NO. 3484

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0364, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The attached report addresses the first year of a program aimed at developing basic solutions to carbon/carbon composite oxidation. In particular, one primary thrust is the development of boron containing carbons through pyrolysis of boron containing polymers. Additionally, a basic understanding of the oxidation mechanisms in carbons and boron containing carbons is being sought. Several new boron containing precursors have been synthesized, which can be converted to B/C materials after pyrolysis. In particular, polyacrylonitrile (PAN) has been copolymerized with a boron-containing monomer (vinylcatecholborane.) Approximately 68% of the original boron is retained after pyrolysis yielding a product with 3.4% boron. 1,4-polybutadiene (PBD) has been hydroborated to contain large amounts of boron. Model compounds have been used to prepare polydiyne with considerable amounts of boron. In the latter two cases, direct analysis for % boron is not yet available. Preliminary TGA data suggests that PBD containing boron results in a more stable structure.

DESCRIPTORS: (U) \*CARBON CARBON COMPOSITES, \*OXIDATION, \*BORON, \*POLYMERS, \*POLYBUTADIENE, \*ACRYLONITRILE POLYMERS, PYROLYSIS, PRECURSORS, SYNTHESIS, COMPOSITE

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AD-A280 445 21/8.1

CALIFORNIA UNIV SAN DIEGO LA JOLLA

(U) Fundamentals of Acoustic Instabilities in Liquid Propellant Rockets.

DESCRIPTIVE NOTE: Annual rept. Feb 92-Feb 93,

APR 92 6P

PERSONAL AUTHORS: Williams, F. A.

CONTRACT NO. AFOSR-91-0130

MONITOR: AFOSR, XC  
TR-94-0367, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) In this program, equations were written describing combustion instability in liquid-propellant rocket motors. The nonhomogeneous nature of the acoustic medium was taken into account, with the possibility of both subcritical and supercritical bifurcations occurring in the liquid-gas system. Attention was focused on characteristic times of the various flow, mixing and combustion processes as they arise in the newer engines of interest to the Air Force, in an effort to identify important physical phenomena in the instability and to achieve tractable descriptions of the instability processes. Theory was compared with available experimental observations in an effort to evaluate current theoretical capabilities. Combustion instability, Liquid-propellant rockets

DESCRIPTORS: (U) \*LIQUID PROPELLANT ROCKET ENGINES, ACOUSTICS, AIR FORCE, ATTENTION, COMBUSTION, EQUATIONS, FLOW, INSTABILITY, LIQUID PROPELLANTS, MIXING, MOTORS, OBSERVATION, ROCKETS, THEORY, TRACTABLE.

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HOUSTON UNIV TX DEPT OF BIOCHEMICAL AND BIOPHYSICAL SCIENCES

(U) Gene Regulation in Memory Formation and Circadian Rhythms.

DESCRIPTIVE NOTE: Annual rept. Sep 92-May 94,

MAY 94 14P

PERSONAL AUTHORS: Eskin, Arnold

CONTRACT NO. F49620-92-J-0494

PROJECT NO. 2312

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0369, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) One general objective of this research is to investigate the role of gene expression in circadian rhythms and in memory formation. Another general objective of this research is to develop a new system suitable for both biochemical and molecular studies of circadian rhythms. More specifically, having previously identified a number of proteins that may play important roles in memory formation and circadian rhythms, we wished to explore the function of regulation of expression of the genes for these proteins. Our most important progress to date is in developing techniques suitable for measuring changes in gene expression in the *Aplysia* nervous system (e.g., ribonuclease protection assays) and in developing probes for many *Aplysia* genes (calmodulin, Bip, porin, HSP-70, ribosomal mRNA, phosphoglycerate kinase, C/EBP, etc.). At this stage, we are at the exciting point where we have just begun to use these techniques and reagents to characterize the regulation of these genes. With regard to the development of model systems for molecular research, we have been unable to observe a circadian rhythm in *Halobacteria*. We will continue to pursue development of *Halobacteria* as well as *Nematodes* and *Yeast*.

DESCRIPTORS: (U) \*CIRCADIAN RHYTHMS, \*MEMORY (PSYCHOLOGY),

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GENES, APLYSIA, NERVOUS SYSTEM, RIBONUCLEIC ACIDS, YEASTS, PROTEINS.

MICHIGAN STATE UNIV EAST LANSING DEPT OF MECHANICAL ENGINEERING

IDENTIFIERS: (U) WUAFOSR2312BSCS.

(U) Unsteady Flow Field of Large-Amplitude Pitching Airfoils.

DESCRIPTIVE NOTE: Final technical rept. Jul 92-Nov 93,

FEB 94 33P

PERSONAL AUTHORS: Koochesfahani, Manoochehr M.

CONTRACT NO. AFOSR-89-0417

PROJECT NO. 2307

TASK NO. A3

MONITOR: AFOSR, XC  
TR-94-0355, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This research program investigated the physical mechanisms involved in the onset of leading edge separation when airfoils pitch to high angles of attack. Both constant pitch rate and variable pitch rate motions were considered. The highlights of results from a combined experimental and computational effort are described in this report. The conclusions from this research indicate the need for boundary-layer resolved measurements of the flow behavior near the leading edge and the evolution of the reverse flow regions on the suction surface. Furthermore, the deliberate shaping of the pitch trajectory for the purpose of optimization of separation delay is suggested as one way to manage the flow and aerodynamic behavior of an airfoil. Dynamic Stall, Unsteady Separation

DESCRIPTORS: (U) \*AIRFOILS, \*PITCH(INCLINATION), \*ANGLE OF ATTACK, \*UNSTEADY FLOW, AERODYNAMICS, BOUNDARY LAYER, HIGH ANGLES, LEADING EDGES, MEASUREMENT, MOTION, OPTIMIZATION, SECONDARY FLOW, SUCTION, SURFACES, TRAJECTORIES, FLOW SEPARATION, STALLING, AERODYNAMIC STABILITY, BOUNDARY LAYER FLOW, ACCELERATION.

IDENTIFIERS: (U) PE61102F, WUAFOSR2307A3.

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PITTSBURGH UNIV PA

(U) Materials Research Center, University of Pittsburgh.

DESCRIPTIVE NOTE: Final rept. 1 Nov 91-28 Feb 94,

APR 94 384P

PERSONAL AUTHORS: Hercules, D. M.; Pettit, F. S.; Mayer, G.

CONTRACT NO. AFOSR-91-0441

PROJECT NO. 3484

TASK NO. B3

MONITOR: AFOSR, XC  
TR-94-0354, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The research and related activities at the Materials Research Center (MRC) of the University of Pittsburgh under AFOSR Grant 91-0441 are summarized. The research program has progressed in four technical areas. Nine projects under the heading of High-Performance Materials are discussed and include degradation of intermetallics and composites at elevated temperatures, deformation behavior of alloys during processing and service, and development of polymers with improved mechanical properties through microstructure control. Thirteen projects have involved Electro-optics. The development of new organic optoelectronic materials employing the design and synthesis of molecules, polymers, and molecular clusters is described and the tailoring of materials in specific device structures, such as IR detectors, light emitters, or filters is discussed. Five projects involve investigations related to Biotechnology where bioactive proteins as smart materials, viral proteins as templates for bioactive materials, and molecular recognition elements have been studied. In the Catalysis technical area, the results from studies on decomposition of nerve gases, and catalysts related to alternate fuels are presented. Educational aspects of the Center are also summarized. New equipment capabilities are reviewed, as well as internal and external

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collaborations of the MRC. Finally, the future plans for the MRC are addressed. High performance materials, Optoelectronics, Biotechnology, Catalysis, Diamond quantum well structures, Thin film ferroelectrics, Nonlinear optical materials, Biosensors, Molecular recognition, Neurochemical compounds, Smart materials.

DESCRIPTORS: (U) \*COMPOSITE MATERIALS, \*POLYMERS, \*CERAMIC MATERIALS, \*METALS, ALLOYS, BIOTECHNOLOGY, CATALYSIS, CATALYSTS, HIGH TEMPERATURE, DECOMPOSITION, DEFORMATION, DEGRADATION, DETECTORS, ELECTROOPTICS, INFRARED DETECTORS, DIAMONDS, EMITTERS, FILTERS, FERROELECTRIC MATERIALS, METAL MATRIX COMPOSITES, LIGHT, MECHANICAL PROPERTIES, MICROSTRUCTURE, CERAMIC MATRIX COMPOSITES, MOLECULES, OPTICAL MATERIALS, POLYMERIC FILMS, PROCESSING, PROTEINS, QUANTUM WELLS, SEMICONDUCTORS, SYNTHESIS, TEMPLATES, THIN FILMS.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484B3, Intermetallics, Smart materials, Diamonds films.

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AD-A280 411 CONTINUED

WASHINGTON STATE UNIV PULLMAN DEPT OF PHYSICS

(U) Defect Initiation/Growth and Energy Dissipation Induced by Deformation and Fracture.

DESCRIPTIVE NOTE: Final technical rept. 15 Dec 92-14 Dec 93,

MAY 94 50P

PERSONAL AUTHORS: Dickinson, J. T.

CONTRACT NO. F49620-91-C-0093

PROJECT NO. 2302

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0357, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Based on our capabilities to (a) detect and characterize particle release from surfaces on fast time scales, (b) to measure rapid electrical transients, and (c) to obtain high resolution topographical information utilizing scanning tunneling and atomic force microscopy, we have investigated a number of defect initiation and growth processes which ultimately leads to fracture and energy dissipation. We employ dynamic methods as well as post-fracture examination in polymers, ceramics, metals, and interfaces. We have examined mechanisms, with interpretation and connections between these results and the creation and evolution of defects in materials under mechanical stress. The information we are acquire with our techniques has important implications concerning dissipation of energy (e.g., plastic deformation, microcracking, crack branching, and crack deflection) which play critical roles in controlling the strength and toughness of materials. Deformation, Crack propagation, Fracture, Particle emission, Fracture-emission, Interfacial failure, Cracking, Electrical transients, Micro-Cracking, Contact charging, Fractography, Scanning tunneling, Microscopy, Atomic force microscopy, Photoluminescence, Chemisorptive electron emission.

DESCRIPTORS: (U) \*CRACK PROPAGATION, \*FRACTURE(MECHANICS) \*CERAMIC MATERIALS, \*METALS, \*COMPOSITE MATERIALS, \*PLASTICS, \*POLYMERS, CRACKS, CRAZING, DEFLECTION, DEFORMATION, DEFECTS(MATERIALS), DISSIPATION, ELECTRON EMISSION, FRACTOGRAPHY, HIGH RESOLUTION, INTERFACES, FAILURE(MECHANICS), TUNNELING(ELECTRONICS), MICROCRACKING, MICROSCOPY, PHOTOLUMINESCENCE, PLASTIC DEFORMATION, SCANNING, TOUGHNESS, TRANSIENTS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2302DS.

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SYRACUSE UNIV NY DEPT OF ELECTRICAL AND COMPUTER  
ENGINEERING

IDENTIFIERS: (U) PE81102F, WUAFOSR2304ES.

(U) Distributed Detection Theory and Data Fusion.

DESCRIPTIVE NOTE: Final rept. 15 Jan 93-14 Jan 94,

MAR 94 5P

PERSONAL AUTHORS: Varshney, Pramod K.

REPORT NO. ECETR-1

CONTRACT NO. F49620-93-1-0122

PROJECT NO. 2304

TASK NO. ES

MONITOR: AFOSR, XC  
TR-84-0385, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Design of distributed order statistic constant false alarm rate (OS-CFAR) detection systems with data fusion was investigated. Its performance for different fusion rules and for a variety of nonhomogeneous backgrounds such as clutter edges and interfering targets was analyzed. Issues related to sampling and quantization in distributed detection systems were addressed. Sampling schemes for signal detection based on All-Silvey distance measures were derive. Performance enhancement over uniform sampling was shown. A number of collaborative research projects with Rome Laboratory engineers were carried out. The most notable one was the development of a prototype of an expert system CFAR (ES-CFAR) processor. This processor intelligently selects the CFAR algorithm based upon the observed characteristics of the environment. Substantial performance improvement over a conventional CFAR processor was demonstrated. Distributed detection, Data fusion, Detection theory.

DESCRIPTORS: (U) \*DATA FUSION, \*TARGET DETECTION, \*RADAR, ALGORITHMS, AUGMENTATION, BACKGROUND, CLUTTER, EXPERT SYSTEMS, FALSE ALARMS, ORDER STATISTICS, PROTOTYPES, SAMPLING, SIGNALS, WARNING SYSTEMS.

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AD-A280 380 CONTINUED

CONDUCTUS INC SUNNYVALE CA

(U) Submillimeter Quasioptical Josephson Junction Oscillator with Integrated Tuning Elements.

DESCRIPTIVE NOTE: Final rept. 1 Jul 93-28 Feb 94,

APR 94 27P

PERSONAL AUTHORS: Pance, Aleksandar; Barfknecht, Andrew

REPORT NO. 94003-SBIR-2-F

CONTRACT NO. F49620-93-C-0037

PROJECT NO. 1602

TASK NO. 01

MONITOR: AFOSR, XC  
TR-94-0347, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The goal of this program was to demonstrate a Quasioptical Josephson Oscillator with Integrated Tuning Elements using standard Conductus niobium technology. This device is based on a novel approach that incorporates integrated tuning and impedance-matching structures at every Josephson junction/antenna pair. The device has been designed, fabricated and successfully tested. A new, unit cell has been devised, incorporating a sub-array of 1 to 16 Josephson junctions. Microstrip transformers are used locally between each sub-array and its antenna. The oscillator with 110 Josephson junctions and bow-tie antennas was found to radiate close to its maximum available power at 115 GHz. The on-chip SIS radiation detector has detected 2.64 nW of power. The oscillator was tuned across 19 GHz, or 16% of fractional bandwidth, in reasonable agreement with the predicted value of 19%. This is the first demonstration of a distributed array Josephson oscillator, where each junction feeds its own antenna and phase-locks to the radiation of other junctions. It is also the first demonstration of using integrated microstrip tuning and impedance matching elements at every Josephson junction of an oscillator. Finally, this is the first distributed Josephson oscillator reported to date that appears to

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radiate close to its maximum available power. Submillimeter, Oscillators, Antenna arrays, Superconducting electronics, Quasioptical.

DESCRIPTORS: (U) \*JOSEPHSON JUNCTIONS, \*OSCILLATORS, \*TUNING, \*INTEGRATED SYSTEMS, \*OPTICS, \*SUBMILLIMETER WAVES, ANTENNA ARRAYS, ANTENNAS, BANDWIDTH, CELLS, DETECTORS, ELECTRONICS, IMPEDANCE MATCHING, NIOBIUM, PHASE, POWER, RADIATION, STANDARDS, STRUCTURES, TRANSFORMERS, SUPERCONDUCTIVITY, RADIO WAVES.

IDENTIFIERS: (U) WUAFOSR160201, PE63218C, \*Quasioptical, Microstrip, SIS, Phase locks

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 GEORGIA UNIV ATHENS DEPT OF CHEMISTRY  
 (U) Mass-Analyzed Threshold Ionization Spectroscopy of  
 AlAr,

AD-A280 368 11/2  
 NEW MEXICO UNIV ALBUQUERQUE

(U) Interaction Effects of Cracks, Flaws and Damage in  
 Ceramic.

DESCRIPTIVE NOTE: Final rept. Sep 92-Mar 94,

MAY 94 8P  
 PERSONAL AUTHORS: Willey, K. F.; Yeh, C. S.; Duncan, M. A.

MAY 94 102P

PERSONAL AUTHORS: Schreyer, Howard L.; Wang, Ming L.

CONTRACT NO. F49620-94-1-0063

CONTRACT NO. AFOSR-91-0419

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC

TR-94-0344, AFOSR

MONITOR: AFOSR, XC

TR-94-0352, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Chemical Physics Letters, v211 p158,  
 1993. Available only to DTIC users. No copies furnished  
 by NTIS.

ABSTRACT: (U) Mass-Analyzed Threshold Ionization  
 Spectroscopy (MATI) spectroscopy is applied for the first  
 time to a metal van der Waals complex, Al-Ar. The  
 vibrationally resolved spectrum yields the vibrational  
 frequency for the ground state of the Al-Ar cation (67 /  
 cm) and the fundamental frequency for the neutral Al-Ar  
 van der Waals complex (39 /cm). Clusters, Photoionization,  
 Ion-molecule complexes.

DESCRIPTORS: (U) \*CATIONS, \*IONIZATION, \*MASS,  
 \*SPECTROSCOPY, \*ALUMINUM, \*ARGON, \*VAN DER WAALS FORCES,  
 FREQUENCY, GROUND STATE, IONS, METALS, MOLECULES, NEUTRAL,  
 PHOTOIONIZATION, VIBRATION, ION MOLECULE INTERACTIONS,  
 VOLTAGE, THRESHOLD EFFECTS, REPRINTS.

IDENTIFIERS: (U) WUAFOSR2303ES, PE61102F, \*Threshold,  
 \*MATI(Mass-Analyzed Threshold Ionization), TOF(Time of  
 Flight).

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UNCLASSIFIED REPORT

ABSTRACT: (U) It is generally recognized that the nature  
 of grain boundaries and microstructures affects the  
 properties and behavior of ceramics. One of the  
 objectives of this research is to study the fracture  
 process of the ceramic in real time and to measure the  
 strain field in the vicinity of the crack including the  
 bridging zones. A fast-scanning electron microscope (FSEM)  
 for dynamic microscopy applications was used to capture  
 the fracture events in the ceramic. This equipment  
 captures images at high speed. The SEM chamber was also  
 modified to accommodate an in-situ tension-compression  
 loading device to fracture ceramics. The fracture mode  
 was predominantly intergranular. No indication of a  
 microcrack-cloud zone was observed in the FSEM results.  
 Grain bridging was observed along the entire crack  
 interface and over the entire propagation distance. Grain  
 boundaries, Microstructures.

DESCRIPTORS: (U) \*CERAMIC MATERIALS, \*DEFECTS(MATERIALS),  
 \*FRACTURE(MECHANICS), \*CRACKING(FRACTURING), COMPRESSION,  
 CRACKS, ELECTRON MICROSCOPES, GRAIN BOUNDARIES, IMAGES,  
 INTERFACES, MICROSCOPY, REAL TIME, SCANNING ELECTRON  
 MICROSCOPES, TENSION, VELOCITY, INTERACTIONS, DAMAGE  
 ASSESSMENT, MESH, MICROSTRUCTURE, CRACK PROPAGATION,  
 STRAIN(MECHANICS), MICROCRACKING, BRITTLENESS, ALUMINATES,  
 DEFORMATION, FINITE ELEMENT ANALYSIS.

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SOCIETY OF ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY  
WASHINGTON DC

IDENTIFIERS: (U) PEG1102F, WUAFOSR2302D5.

(U) Environmental Fate of a Complex Mixture, Creosote, in  
Two Species of Fish.

DESCRIPTIVE NOTE: Rept. 1 Dec 90-30 Nov 91, (Final),

APR 94 118P

PERSONAL AUTHORS: Sanasack, ; Nishimoto, Marc

CONTRACT NO. AFOSR-89-C-0192

PROJECT NO. 2312

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0341, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The metabolic fate of components of creosote, as well as the creosote mixture, was studied in two species of fish, English sole (*Pleuronectes vetulus*) and rainbow trout (*Oncorhynchus mykiss*). Laboratory experiments were conducted to assess the metabolism and DNA adduct formation of aromatic compounds by these fish species. These studies were conducted to determine whether the metabolic pathways of creosote components are similar between fish species which have been shown to be susceptible to hepatotoxic effects of components of creosote. In addition, comparisons of the metabolic products of creosote components formed in live animals and by isolated liver cells were made to determine whether isolated hepatocytes may be used as an alternative to live animals in delineating the mechanisms of metabolism of individual compounds and complex mixtures of xenobiotics. Isolated hepatocytes from English sole and rainbow trout were exposed to either benzo(a)pyrene (Bap), a component of creosote, or a creosote extract and the types of metabolites formed were assessed by reversed-phase liquid chromatography (RPLC) or gas chromatography/mass spectrometry (GC/MS). The types of DNA adducts formed during the metabolism of Bap or the creosote mixture were determined using the 32P postlabeling assay. The results showed that Bap was

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metabolized by English sole and rainbow trout hepatocytes primarily to glucuronide conjugates of hydroxylated Bap derivatives, similar to those detected in bile of English sole exposed to Bap in vivo.

DESCRIPTORS: (U) \*CREOSOTE, \*FISHES, \*METABOLISM, \*EXPOSURE(PHYSIOLOGY), \*TOXICITY, AROMATIC COMPOUNDS, BILE, GAS CHROMATOGRAPHY, LIQUID CHROMATOGRAPHY, LIVER, MASS SPECTROMETRY, RADIOACTIVITY, TROUT, URONIC ACIDS, EXTRACTION, SEDIMENTS, CHEMICAL ANALYSIS, FRACTIONATION, IN VITRO ANALYSIS, IN VIVO ANALYSIS, AUTORADIOGRAPHY, DEOXYRIBONUCLEIC ACIDS, ELUTION.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312AS, Oncorhynchus mykiss, Hepatocytes, Xenodolitics, Genotoxicity, Reversed phase chromatography, Benzoapyrene

AD-A280 360 17/10 19/11 19/9 5/4

SOUTHERN METHODIST UNIV DALLAS TX DEPT OF GEOLOGICAL SCIENCES

(U) The Role of Portable Instrumentation in Monitoring a Comprehensive Test Ban Treaty.

DESCRIPTIVE NOTE: Annual rept. Jan 93-Feb 94,

APR 94 268P

PERSONAL AUTHORS: Stump, Brian W.; Riviere-Barbier, Florence; Chernoby, Igor; Koch, Karl

REPORT NO. SMU-5-25155

CONTRACT NO. F49620-93-1-0146

PROJECT NO. 2309

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0350, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report documents two efforts undertaken during the past 12 months. The first describes a combined near-source/regional monitoring of a series of mining blasts in Southern Russia. The second contribution describes a theoretical investigation of nuclear explosion source model resolution using near-source seismic data in a nonlinear inversion scheme. Mining explosion, Nuclear explosion, Seismic source function.

DESCRIPTORS: (U) \*SEISMIC DETECTION, \*NUCLEAR EXPLOSION DETECTION, \*MINES(EXCAVATIONS), \*UNDERGROUND EXPLOSIONS, BLAST, EXPLOSIONS, MODELS, MONITORING, ARMS CONTROL, SEISMIC DISCRIMINATION, NUCLEAR EXPLOSIONS, SEISMIC DATA, USSR, CONSTRUCTION, SEISMIC WAVES, PORTABLE EQUIPMENT.

IDENTIFIERS: (U) PE61102F, WUAFOSR2305AS, Test ban treaties.

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INDIANA UNIV-PURDUE UNIV AT COLUMBUS DEPT OF BIOLOGY

MARYLAND UNIV COLLEGE PARK

(U) Two-Dimensional Protein Pattern Recognition in Chemical Toxicity.

(U) Theoretical Investigations of Chaotic Dynamics.

DESCRIPTIVE NOTE: Annual rept. 1 Apr 93-30 Mar 94,

DESCRIPTIVE NOTE: Final rept. 1 Nov 91-31 Oct 93,

APR 94 47P

OCT 93 12P

PERSONAL AUTHORS: Witzmann, Frank A.

PERSONAL AUTHORS: Yorke, James

CONTRACT NO. F49620-93-1-0297

CONTRACT NO. F49620-92-J-0033

PROJECT NO. 2312

PROJECT NO. 2304

TASK NO. A5

TASK NO. BS

MONITOR: AFOSR, XC

MONITOR: AFOSR, XC

TR-94-0346, AFOSR

TR-04-0348, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) This report summarizes the progress made in the development of a two-dim pro database for toxicity screening and mechanistic determination. Various chemically distinct peroxisome proliferators were compared with regard to their effect on the 2 protein pattern of various target tissues in the rodent. Protein alterations, novel identifications, and future directions are described. Rat liver, Rat kidney, Rat testis, perfluorocarboxylic acid peroxisome proliferator, 2D protein electrophoresis, Image analysis, Protein sequence, Pattern Recognition.

DESCRIPTORS: (U) \*ELECTROPHORESIS, \*LIVER, \*TOXICITY, ACIDS, DATA BASES, DETERMINATION, IMAGES, KIDNEYS, PATTERN RECOGNITION, PATTERNS, PROTEINS, RATS, RECOGNITION, RODENTS, SEQUENCES, TARGETS, TWO DIMENSIONAL, ENZYMES, FATTY ACIDS, CHEMICALS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312A5, Rat liver, Rat kidney, Rat testis, \*perfluorocarboxylic acid, Two dimensional electrophoresis

ABSTRACT: (U) An important component of the work for AFOSR was the discovery and investigation of 'riddled basins'. A riddled basin for a chaotic attractor's basin is arbitrarily close to points in another attractor's basin (the first basin is riddled with holes). When an attractor has a riddled basin there is an extreme end-state sensitivity to initial conditions in thier sense that for any initial condition in the riddled basin an arbitrarily small error in computation can result in the erroneous prediction-of which attractor the initial condition is eventually attracted to. This contrasts with the more usual situation of a chaotic attractor with a non-riddled basin where any error in computation propagates exponentially but one can reliably say which attractor the initial condition is attracted to. Since the researchers discovery of the phenomenon of riddled basins, physical examples have been found in scattering, statistical mechanical, and ecological models. As can be seen from the bibliography, they have also done extensive work in other areas of dynamics, including the properties of indecomposable continua occurring in models o turbulent fluid flow.

DESCRIPTORS: (U) \*CHAOS, \*DIFFERENTIAL EQUATIONS, NONLINEAR SYSTEMS, CONTROL THEORY, BIFURCATION(MATHEMATICS), PERTURBATION THEORY.

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IDENTIFIERS: (U) Riddled Basins(Mathematics),  
WUAFOSR2304BS, PE61102F

GEORGIA UNIV ATHENS DEPT OF CHEMISTRY

(U) Cluster-Ion Photodissociation and Spectroscopy in a  
Reflection Time-of-Flight Mass Spectrometer,

94 8P

PERSONAL AUTHORS: Willey, K. F.; Robbins, D. L.; Yeh, C.  
S.; Duncan, M. A.

CONTRACT NO. F49620-94-1-0063

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0345, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Time-of-Flight Mass Spectrometry,  
ACS Symposium Series 549, Chapter 4, p61-72 1994.  
Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) We describe a novel configuration of a  
reflection time-of-flight mass spectrometer and its  
applications to the study of metal cluster ions. The  
instrument operation configuration and principles are  
explained, as well as the interface of this with a laser  
vaporization cluster source. Experimental arrangements  
are described to obtain the fragmentation channels of  
cluster ions and their photodissociation excitation  
spectroscopy. Clusters, Mass spectrometry,  
Photodissociation.

DESCRIPTORS: (U) \*IONS, \*METALS, \*PHOTODISSOCIATION,  
\*SPECTROMETERS, \*SPECTROSCOPY, CHANNELS, CONFIGURATIONS,  
EXCITATION, FRAGMENTATION, MAGNESIUM, CARBON DIOXIDE,  
INTERFACES, LASERS, MASS SPECTROMETERS, MASS SPECTROMETRY,  
OPERATION, REPRINTS, SPECTROMETRY, VAPORIZATION, PULSES,  
BENZENE, MOLECULES.

IDENTIFIERS: (U) WUAFOSR2303ES, \*Clusters, \*Reflection,  
Time-of-flight, TOF.

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GEORGIA UNIV ATHENS DEPT OF CHEMISTRY

GEORGIA UNIV ATHENS DEPT OF CHEMISTRY

(U) Photodissociation Spectroscopy of Mg<sup>+</sup>-Ar.

(U) Photodissociation of Magnesium Ion/Molecule Complexes  
In a Reflectron Time-of Flight Mass Spectrometer.

JUL 93 6P

94 16P

PERSONAL AUTHORS: Yeh, C. S.; Pilgrim, J. S.; Duncan, M. A.

PERSONAL AUTHORS: Yeh, C. S.; Willey, K. F.; Robbins, D. L.; Duncan, M. A.

CONTRACT NO. F49620-94-1-0063

CONTRACT NO. F49620-94-1-0063

PROJECT NO. 2303

PROJECT NO. 2303

TASK NO. ES

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0343, AFOSR

MONITOR: AFOSR, XC  
TR-94-0342, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

Availability: Pub. in Chemical Physics Letters, v210 n4, 5, 6, 30 Jul 93. Available to DTIC users only. No copies furnished by NTIS.

Availability: Pub. in International Jnl. of Mass Spectroscopy and Ion Processes, v131 p307-317 1994. Available to DTIC users only. No copies furnished by NTIS.

ABSTRACT: (U) Mg<sup>+</sup>-Ar ion-molecule complexes are produced in a pulsed supersonic nozzle cluster source and studied with laser photodissociation spectroscopy in a reflectron time-of-flight mass spectrometer. An electronic transition is observed with an origin at 31,387 /cm. The excited state vibrational frequency is 272 /cm. The dissociation energy derived from a fit of the potential surface and a thermochemical cycle is 1270 /cm for the ground state. Clusters, ion-molecule complexes, Electronic spectroscopy.

ABSTRACT: (U) Ion-molecule complexes containing magnesium and small molecules such as water or carbon dioxide are prepared in a laser vaporization pulsed nozzle cluster source. The electronic spectroscopy and photochemistry of these complexes are studied with photodissociation spectroscopy in a reflectron time-of-flight mass spectrometer. Structured electronic spectra with resolved vibrational features are observed for several of the complexes. These spectral features make it possible to determine the vibrational frequencies and dissociation energies of the complexes. In other complexes, photoinduced reactions are initiated by the absorption of light, and the details of these intracomplex reactions are investigated. The complexes are found to be best represented by electrostatic bonding, with structures which are predictable from these considerations. Clusters, Electronic spectra, Photochemistry.

DESCRIPTORS: (U) \*PHOTODISSOCIATION, \*SPECTROSCOPY, \*MAGNESIUM, \*CATIONS, \*ARGON, CYCLES, DISSOCIATION, ELECTRONICS, ENERGY, FREQUENCY, GROUND STATE, IONS, LASERS, MASS SPECTROMETERS, MOLECULES, NOZZLE CLUSTERS, SUPERSONIC NOZZLES, SURFACES, TRANSITIONS, REPRINTS, ION MOLECULE INTERACTIONS, ELECTRONIC STATES, METALS, ATOMIC ORBITALS, COMPLEX IONS, RARE GASES.

IDENTIFIERS: (U) WUAFOSR2303ES, \*Reflectron time-of-flight, TOF, \*Clusters, Chemical physics.

DESCRIPTORS: (U) \*IONS, \*MAGNESIUM, \*MASS SPECTROMETERS, \*MOLECULES, \*PHOTODISSOCIATION, \*COMPLEX IONS, ABSORPTION, BONDING, CARBON DIOXIDE, DISSOCIATION, ELECTRONICS, ELECTROSTATICS, FLIGHT, FREQUENCY, LASERS, LIGHT, NOZZLE

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CLUSTERS, NOZZLES, PHOTOCHEMICAL REACTIONS, SPECTRA,  
SPECTROSCOPY, STRUCTURES, VAPORIZATION, WATER, REPRINTS,  
ION MOLECULE INTERACTIONS, VIBRATION.

IDENTIFIERS: (U) WUAFOSR2303ES, \*Reflection, Time-of-  
flight, \*Clusters.

AD-A280 284 13/8 12/5

PITTSBURGH UNIV PA DEPT OF MATHEMATICS AND STATISTICS  
(U) Simulation of Manufacturing Processes.

DESCRIPTIVE NOTE: Final rept., 1 Dec 89-31 Dec 93,  
MAY 94 31P

PERSONAL AUTHORS: Hall, C. A.; Porsching, T. A.

CONTRACT NO. AFOSR-90-0094

PROJECT NO. 2304

TASK NO. A3

MONITOR: AFOSR, XC  
TR-94-0351, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report summarizes research surrounding the simulations of two manufacturing processes-the finishing and/or repair of material surfaces and the stamping of sheet metal parts. Regarding the surface finishing project, a unified mathematical theory for the process of material removal by abrasion (grinding and polishing) was developed. Then strategies were formulated for material removal by Operator controlled (OC) or Computer Numerically Controlled (CNC) machines. For the sheet metal stamping project, certain asymmetric numerical solution were characterized as symmetry breaking

DESCRIPTORS: (U) \*MANUFACTURING, \*COMPUTERIZED SIMULATION, ABRASION, COMPUTERS, EQUATIONS, FORMULATIONS, GRINDING, MACHINES, MATERIALS, METALS, POLISHING, REMOVAL, REPAIR, SHEET METAL, SHEETS, SIMULATION, STRATEGY, SURFACES, SYMMETRY, THEORY, SURFACE FINISHING.

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AD-A280 059 CONTINUED

MATERIALS RESEARCH SOCIETY PITTSBURGH PA

(U) Physics and Applications of Defects in Advanced Semiconductors. Materials Research Society Symposium Proceedings. Volume 325.

DESCRIPTIVE NOTE: Final rept..

94 538P

PERSONAL AUTHORS: Ballance, John

CONTRACT NO. F49620-94-1-0062

PROJECT NO. 2305

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0318, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Defect characterization, identifications, and their influence on material properties and device performance are a major subject in the physics and applications of semiconductors. This volume focuses on defects in advanced semiconductors or precisely quantum wells, superlattices, and heterostructures. In Part I of this proceedings the invited and contributed papers deal with defects in type I and type II superlattices based on III-V semiconductors such as GaAs/AlGaAs multiple quantum wells (MQWs). Some of the topics include optical spectroscopy of defects in GaAs/AlGaAs MQWs, defects injections and diffusions in heterostructures and impurity effects on the electronic states in quantum wires and quantum dots. Part II deals with defects and impurities in bulk and epitaxial InP and related compounds, for example, the semi-insulating behavior of undoped InP is discussed. Recently, SiGe/Si quantum wells and heterostructures have been the subject of an increasing interest due to their applications in electronic and opto-electric devices. Defects, dislocation distributions, and doping in these heterostructures are discussed in Part III.

DESCRIPTORS: (U) \*SEMICONDUCTORS, \*DEFECT ANALYSIS, \*PHYSICS, \*COMPOSITE MATERIALS, \*QUANTUM WELLS,

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\*SUPERLATTICES, \*BULK MATERIALS, SYMPOSIA, GROUP III COMPOUNDS, GROUP IV COMPOUNDS, GROUP V COMPOUNDS, GALLIUM ARSENIDES, ALUMINUM GALLIUM ARSENIDES, SPECTROSCOPY, OPTICS, DIFFUSION, IMPURITIES, ELECTRONIC STATES, EPITAXIAL GROWTH, INDIUM, PHOSPHIDES, SILICON, GERMANIUM, DISLOCATIONS, DOPING, HETEROJUNCTIONS, BIPOLAR TRANSISTORS, STOICHIOMETRY, PRECIPITATION.

IDENTIFIERS: (U) WUAFOSR2305ES, PE61102F, MQW(Multiple Quantum Wells), Heterostructures, Quantum wires, Quantum dots, Optoelectronic devices, LTG(Low Temperature Grown)

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UNIVERSITY OF MANCHESTER INST OF SCIENCE AND TECHNOLOGY  
(UNITED KINGDOM) DEP T OF PHYSICS

SOUTH CAROLINA UNIV COLUMBIA DEPT OF PSYCHOLOGY

(U) Role of Working Memory Limitations of Retrieval.

(U) The Initiation of Lightning and the Growth of Electric Fields in Thunderstorms.

DESCRIPTIVE NOTE: Annual technical rept. May 93-May 94,

DESCRIPTIVE NOTE: Final rept. 1 Nov 91-31 Mar 94,

MAY 94 10P

DEC 93 60P

PERSONAL AUTHORS: Engle, Randall W.

PERSONAL AUTHORS: Latham, John

CONTRACT NO. F49620-93-1-0336

REPORT NO. UMIST/PHYS/2

PROJECT NO. 2313

CONTRACT NO. F49620-92-J-0020

TASK NO. BS

PROJECT NO. 2310

MONITOR: AFOSR, XC  
TR-94-0332, AFOSR

TASK NO. CS

UNCLASSIFIED REPORT

MONITOR: AFOSR, XC  
TR-94-0317, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Further research into the glaciation of convective clouds of-the type that produce lightning has revealed that the early stages of ice formation can be detected by measurement of the supercooled droplet radius - a result which also has climatological implications. Further laboratory experiments have shown that the most effective methods of lightning initiation are likely to involve supercooled raindrops, with threshold fields around 300kV/m. A new model of thundercloud electrification and lightning production has been developed, from which it is possible to deduce the sensitivity of lightning frequency to meteorological and cloud microphysical parameters. Lightning, Ice, Corona, Electric field.

DESCRIPTORS: (U) \*ELECTRIC FIELDS, \*ICE FORMATION, \*LIGHTNING, \*THUNDERSTORMS, CORONAS, CUMULONIMBUS CLOUDS, FREQUENCY, RAINDROPS, SENSITIVITY, MATHEMATICAL PREDICTION, ATMOSPHERIC MOTION.

IDENTIFIERS: (U) PES1102F, WUAFOSR2310CS.

AD-A280 033

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ABSTRACT: (U) Over the past year, 11 studies have been completed on the role of working memory limitations on storage retrieval of information. One series demonstrated that, if subjects are highly trained and there is no interference among the items being retrieved, working memory limitations play no role in retrieval. However if there is interference among the information being retrieved, individuals low in working memory capacity suffer in retrieval from active memory compared to high working memory individuals. Regardless of interference condition, however, working memory capacity plays no role in retrieval from inactive or secondary memory. A second series of studies demonstrated that the phonological similarity effect, one of the primary sources of evidence for the articulatory loop, is not found if the words in the lists to be recalled are chosen from an unlimited set and presented silently. This casts doubt on the generality of this code, particularly for silent reading. Working memory capacity, Attention, Resources, Capacity, Inhibition, Task sharing.

DESCRIPTORS: (U) \*MEMORY(PSYCHOLOGY), \*INFORMATION RETRIEVAL, ATTENTION, INHIBITION, INTERFERENCE, LIMITATIONS, LOOPS, READING, RECREATION, RESOURCES, SECONDARY, SHARING, STORAGE, COGNITION.

IDENTIFIERS: (U) PES1102F, WUAFOSR2313BS.

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CALIFORNIA UNIV SANTA CRUZ DEPT OF PSYCHOLOGY AND  
PSYCHOBIOLOGY

EYE, LUMINANCE, MOVING TARGETS, PREDICTIONS, RATES,  
READING, SPACE PERCEPTION, SUPPRESSION, TARGETS,  
TERMINALS, VELOCITY, VISUAL SIGNALS.

(U) Space Constancy on Video Display Terminals.

IDENTIFIERS: (U) PE81102F, WUAFOSR2313CS, \*Visual  
display terminals, Psychology.

DESCRIPTIVE NOTE: Final rept. 1 Jan-31 Dec 91,

APR 94 24P

PERSONAL AUTHORS: Bridgeman, Bruce

CONTRACT NO. AFOSR-90-0095

PROJECT NO. 2313

TASK NO. CS

MONITOR: AFOSR, XF  
TR-94-0331, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Flicker of video display terminals (VDTs) has several consequences for visual function: space perception is distorted, and reading is slowed. We first tested the hypothesis that the flicker of VDTs interferes with visual space constancy, the perception that the world remains in the same place despite eye movements. Space constancy was probed by moving targets during eye movements, and noting a difference in movement threshold that depended upon whether a target jumped in the same direction as the eye or the opposite direction. Flicker rates up to 260 Hz distorted perception in a direction that implies breakdown of space constancy. Another experiment investigated the roles of color and luminance mechanisms in space constancy. The conclusion was that perception is actively suppressed during eye movements. The suppression depends on channels in the visual system that are insensitive to chromatic differences. Reading with 60 Hz flicker was 3.05% slower than with 500 Hz flicker. The result is consistent with a hypothesis that under flicker the eye 'parks' following an eye movement, until a new sample of text appears. Processing then proceeds in the usual way. The results allow quantitative predictions of reading speed at an flicker rate.

DESCRIPTORS: (U) \*EYE MOVEMENTS, \*FLICKER,  
\*SCREENS(DISPLAYS), \*VISUAL PERCEPTION, CHANNELS, COLORS,

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MASSACHUSETTS INST OF TECH CAMBRIDGE PLASMA FUSION CENTER

(U) Propulsion Research on the Variable Tandem Mirror Plasma Rocket.

DESCRIPTIVE NOTE: Final rept. 1 Feb 92-31 Jan 94,

FEB 94 90P

PERSONAL AUTHORS: Yang, T. F.; Chang-Diaz, F. R.

REPORT NO. PFC/RR-94-1

CONTRACT NO. NAS9-18372, \$AFOSR-89-0345

PROJECT NO. 2308

TASK NO. A1

MONITOR: AFOSR, XC  
TR-94-0319, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) This report describes the progress made in the past two years as well as the overall picture of this research. In the past years, several milestones have been achieved towards the realization of a practical space plasma thruster from the tandem mirror rocket experiment, i.e. the specific impulse, thrust, energy conversion efficiency, and mass flow-rate have been determined. The experiment operates at 9.4 kW of input power at an rf-to-plasma efficiency of 68%; The ion temperature is 172 eV (2,000,000 K) which gives an I sub sp of 12,852 s. The thrust is 76 mN (milli Newton) which is a high value for a low input power (9.4 kW) and very high I sub sp. (12,852 s). The radiation loss was found to be very low. Most important, these results fall within our prediction.

**DESCRIPTORS:** (U) \*THRUSTERS, \*PLASMA ENGINES, \*ROCKET ENGINES, \*ROCKET PROPULSION, CONVERSION, EFFICIENCY, ENERGY CONVERSION, FLOW RATE, IONS, MASS FLOW, MIRRORS, POWER, RADIATION, ROCKETS, TEMPERATURE, THRUST, LASERS.

**IDENTIFIERS:** (U) WUAFOSR2308A1, PE81102F, Laser optics

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RUTGERS - THE STATE UNIV NEW BRUNSWICK NJ DEPT OF MECHANICAL AND AEROSPACE ENGINEERING

(U) A Numerical Investigation of Energy Transfer and Subgrid-Scale Eddy Viscosity in Homogeneous, Isotropic and Shear Turbulence.

DESCRIPTIVE NOTE: Final technical rept. Dec 91-Dec 93,

MAR 94 94P

PERSONAL AUTHORS: Pelz, Richard B.

CONTRACT NO. AFOSR-91-0248

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0339, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) Numerical solutions to the Navier-Stokes equations for a 3-D, time-dependent, highly-symmetric flow have been completed. An effective resolution of up to 10243 collocation points (341 modes after dealiasing) is attained within the memory on the 256 MW CRAY-2 at Kirtland AFB and the C90 at the Pittsburgh Supercomputer Center. These simulations constitute the highest resolution runs made to date. One of the primary purposes of the work was to create a data base from which a detailed energy transfer and triad analysis could be made by Andrzej Domaradzki at USC. The data base has been made, and runs for Reynolds numbers of 500, 1000, 2000 and 5000 have been stored on tape. We shall give some information concerning the turbulent flows later in this report. The other purpose of this work is to try to understand the transition process through which the flow becomes turbulent. Our early-time analysis of the data base of runs was concerned with this problem, and hence most of this report will deal with our findings. We also attach a manuscript on this subject that will be published shortly in The Physics of Fluids. Turbulent flows, Transition, Numerical simulation.

**DESCRIPTORS:** (U) \*TURBULENT FLOW, \*EDDIES(FLUID

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MECHANICS). \*BOUNDARY LAYER TRANSITION, DATA BASES, ENERGY TRANSFER, NAVIER STOKES EQUATIONS, SUPERCOMPUTERS, VORTEX SHEDDING, DISSIPATION, COMPUTERIZED SIMULATION, VISCOSITY, THREE DIMENSIONAL, TIME DEPENDENCE, HIGH RESOLUTION, REYNOLDS NUMBER, EULER EQUATIONS, SOLUTIONS(GENERAL).

CALIFORNIA INST OF TECH PASADENA DEPT OF ELECTRICAL ENGINEERING

(U) 3-D Optical Memory Disk.

DESCRIPTIVE NOTE: Technical rept. 1 Jul 93-28 Feb 94,

IDENTIFIERS: (U) WUAFOSR2307BS.

APR 94 13P

PERSONAL AUTHORS: Psaltis, Demetri

CONTRACT NO. F49620-92-J-0400

PROJECT NO. 2305

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0335, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Recently, a new method of multiplexing holograms by rotating the material, or equivalently, the recording beams was invented. This method is called Peristroptic (Greek for rotation) multiplexing and is briefly described. Peristroptic multiplexing can be combined with other multiplexing methods to increase the storage density of holographic storage systems such as the previously reported 3-D disk. Peristroptic multiplexing was experimentally demonstrating using Dupont's HRF-150 photopolymer film. A total of 395 holograms were multiplexed in the 38-micrometer thick photopolymer disk by combining peristroptic multiplexing with angle multiplexing. In addition, it is shown that combining both angle and peristroptic multiplexing the storage density of 3-D disks is greatly enhanced.

DESCRIPTORS: (U) \*HOLOGRAMS, \*OPTICAL DATA, \*ROTATION, \*MULTIPLEXING, STORAGE, POLYMERS, MEMORY DEVICES, PHOTOGRAPHIC FILM, DISK RECORDING SYSTEMS, THREE DIMENSIONAL, DIFFRACTION.

IDENTIFIERS: (U) WUAFOSR2305DS, PE61102F, Peristroptic multiplexing, Photopolymers

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A280 000 CONTINUED

AD-A280 000 7/4 7/3 20/2 7/2  
OKLAHOMA STATE UNIV STILLWATER(U) Theoretical Studies of Elementary Chemisorption  
Reactions on an Activated Diamond Ledge Surface,\*FILMS, \*STRUCTURES, ACETYLENES, COEFFICIENTS, DESORPTION,  
REPRINTS, CHEMICAL REACTIONS, ETHYLENE, RATES, CHEMICAL  
RADICALS, TRAJECTORIES, HYDROGEN, VIBRATION.IDENTIFIERS: (U) WUAF0SR2303FS, PE81102F, Activated,  
\*Ledge, Abstraction.

MAY 94 8P

PERSONAL AUTHORS: Perry, Martin D.; Raff, Lionel M.

CONTRACT NO. F49620-92-J-0011

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0337, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Physical Chemistry, v98 n16  
p4375-4381 1994. Available only to DTIC users. No copies  
furnished by NTIS.

ABSTRACT: (U) Rate coefficients, event probabilities,  
and desorption probabilities at 1250 K for chemisorption  
reactions of C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H, CH<sub>3</sub>, CH<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>3</sub>, C<sub>3</sub>H, and  
C(sub n) (n = 1, 2, 3) on an activated diamond ledge  
structure and for H on sp<sup>2</sup> carbon and H on sp<sup>3</sup> carbon are  
computed using classical trajectory methods on the  
empirical hydrocarbon no.1 potential developed by Brenner.  
The results show that the chemisorption rates for  
nonradical species such as C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub> are 2 or more  
orders of magnitude smaller than the values obtained for  
radicals. For ethylene, the chemisorption rate is on the  
order of 10(exp 6) cu cm/(mol s), which is too small to  
permit C<sub>2</sub>H<sub>4</sub> chemisorption to play a role in diamond-film  
formation. The chemisorption rate for acetylene lies in  
the range (1-2) x 10(exp 11) cu cm/(mol s) provided  
acetylene can form two C(sub s)-C bonds to the lattice.  
If only one bond forms, 97% of the acetylene desorbs  
within four C-C vibrational periods. All of the radical  
species have chemisorption rates in the range of 10(exp  
13)-10(exp 13) cu cm/(mol s). The least reactive of the  
radical species investigated is CH<sub>3</sub>. Diamond film,  
Chemisorption.

DESCRIPTORS: (U) \*CARBON, \*CHEMISORPTION, \*DIAMONDS,

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TEXAS A AND M UNIV COLLEGE STATION

AD-A279 995

8/2

CORNELL UNIV ITHACA NY

(U) Stabilization and Control Problems in Structural Dynamics.

(U) Mapping Closures for Turbulent Combustion.

DESCRIPTIVE NOTE: Final technical rept. 1 Jan 91-31 Dec 93,

DESCRIPTIVE NOTE: Final rept. 15 Feb 91-14 Feb 94,

JAN 94

10P

PERSONAL AUTHORS: Chen, Goong; Zhou, Jianxin

PERSONAL AUTHORS: Pope, Stephen B.

CONTRACT NO. AFOSR-91-0097

CONTRACT NO. AFOSR-91-0184

PROJECT NO. 2304

PROJECT NO. 2308

MONITOR: AFOSR, XC  
TR-94-0325, AFOSR

MONITOR: AFOSR, XC  
TR-94-0323, AFOSR

TASK NO. CS

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) Drs. G. Chen and J. Zhou investigated various problems in the analysis, control, optimization and computation of structural mechanical systems and partial differential equations. Three monographs along with over twenty technical papers have been published/written over the support period. The PI's research activities, interaction with Air Force laboratory, video production, and efforts in technology transitions are described in this report. Recent progress in shell equations, computation of fluids and nonlinear partial differential equations is also made through the support of this grant.

DESCRIPTORS: (U) \*COMPUTATIONAL FLUID DYNAMICS, \*STRUCTURAL MECHANICS, AIR FORCE, COMPUTATIONS, DIFFERENTIAL EQUATIONS, FLUIDS, INTERACTIONS, PARTIAL DIFFERENTIAL EQUATIONS, TRANSITIONS, SHELLS(STRUCTURAL FORMS), STABILIZATION, BOUNDARY VALUE PROBLEMS, ELASTIC PROPERTIES.

IDENTIFIERS: (U) PE61102F.

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ABSTRACT: (U) The overall objective of the research program was to develop and test an improved model for the process of molecular diffusion in turbulent reactive flows. In application to turbulent combustion, a major shortcoming of existing models is that they are non-local in composition. A model has been developed, based on the construction of a Euclidean minimum spanning tree (EMST). This model is inspired by the mapping closure, and reduces to it in the case of a single composition. In general, the model is asymptotically local, and hence overcomes a major flaw in previous models. The model has been tested for decaying scalars in isotropic turbulence and for a mean scalar gradient. Additionally, studies have been made of stochastic Lagrangian models for turbulent reactive flows; and an exact expression has been obtained for the probability density function of temperature (or other random quantities) in statistically stationary turbulence. Turbulent combustion, Mixing model.

DESCRIPTORS: (U) \*COMBUSTION, \*TURBULENCE, CLOSURES, CONSTRUCTION, DENSITY, DIFFUSION, GRADIENTS, MAPPING, MEAN, MIXING, MODELS, PROBABILITY DENSITY FUNCTIONS, QUANTITY, STATIONARY, TEMPERATURE, TEST AND EVALUATION, TREES.

IDENTIFIERS: (U) PE61102F, WUAFOSR2308CS.

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AD-A279 994 9/1

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HUGHES RESEARCH LABS MALIBU CA

(U) Pasotron Technology.

month no-cost extension.

DESCRIPTORS: (U) \*AMPLIFIERS, \*OSCILLATORS, AIR FORCE, BANDWIDTH, COSTS, EFFICIENCY, OPERATION, PHASE MEASUREMENT, POWER, POWER LEVELS, STABILITY.

DESCRIPTIVE NOTE: Final rept. 1 Jan-31 Dec 93,

FEB 94 33P

IDENTIFIERS: (U) WUAFOSR2301ES, PASOTRONTM Project

PERSONAL AUTHORS: Butler, J. M.; Goebel, D. M.; Santoru, J.

REPORT NO. HAC-REF-J4924

CONTRACT NO. F49620-92-C-0015

PROJECT NO. 2301

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0311, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This annual report describes research progress made in the second year of the PASOTRON Technology Program. This program is a two year effort sponsored by the Air Force Office of Scientific Research to develop and investigate a single-stage amplifier and a multi-stage oscillator; each based on Hughes' Plasma-Assisted, Slow-Wave Oscillator (PASOTRON) technology. During the program's second year amplifier performance was briefly re-explored to take advantage of system and diagnostic upgrades implemented by HRL under a parallel IR&D Program; and the first stage of the multi-stage oscillator was demonstrated. Data is reported showing improved amplifier performance. Amplifier gains of 10-to-17 dB were maintained; while instantaneous bandwidth was increased from 0.1% to 1.0%. Amplified power levels of several tens to hundred kilowatts were measured to give a factor-of-ten increase in efficiency to levels of a few percent. The first phase measurements were completed, and coherent amplifier operation was achieved with phase stability of up to 0.005 deg/V. Additionally, a multi-stage oscillator system was designed and experimental investigations were conducted on the first stage of the three-stage apparatus. Characterization of the second and third stages will be completed during the program's three-

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MICHIGAN MOLECULAR INST INC MIDLAND

DISULFIDE, CHLORIDES, CHLOROFORM, DIFFUSION, EXTERNAL, FLUIDS, KETONES, LIQUIDS, METHANOLS, METHYLENES, PENETRATION, PLASTICS, SATURATION, SOLUBILITY, TOLUENES, CRAZING, CRACKING(FRACTURING), STRAIN(MECHANICS), POLYETHERS, LIFE EXPECTANCY(SERVICE LIFE), AGING(MATERIALS).

(U) Effect of External Stress on the Transport of Fluids in Thermoplastic Resin Systems.

DESCRIPTIVE NOTE: Final rept. 1 Mar 93-28 Feb 94,

APR 94 89P

IDENTIFIERS: (U) PEG1102F, WUAFOSR2303CS, SEDS(Stress Enhanced Diffusion and Solubility/Swelling), PEEK(Polyetheretherketone)

PERSONAL AUTHORS: Wolf, Clarence T.

CONTRACT NO. F49620-93-1-0198

PROJECT NO. 2303

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0314, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The transport properties of liquid penetrants into the thermoplastic resin, poly aryl ether ether ketone were investigated. The primary objective of this work was to study the effect of external applied stress on the diffusion and solubility/swelling of fluids with PEEK. The solubility and rate of penetration, i.e., diffusion, into the resin system are greatly increased by the application of stress: we call this phenomenon SEDS (stress enhanced diffusion and solubility/swelling). All eight fluids studied, benzene, toluene, methylene chloride, chloroform, carbon disulfide, methanol, acetone, and even water exhibit SEDS. The effect is particularly striking for crystalline PEEK where the solubility is markedly increased and the time to reach saturation, i.e., the induction period is reduced when the applied stress exceeds a critical value. For example, at 22°C the solubility of toluene into 29% crystalline PEEK increases from 9 wt% to almost 40 wt% upon the application of a tensile stress of 35 MPa. Furthermore, the time for 0.25 mm thick crystalline PEEK film to reach its saturation value was reduced from 1000's of hours to less than 10 hours.

DESCRIPTORS: (U) \*THERMOPLASTIC RESINS, \*TRANSPORT PROPERTIES, \*AEROSPACE CRAFT, \*FLUID FLOW, \*STRESS ANALYSIS, ACETONES, ARYL ETHERS, BENZENE, CARBON

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF  
AEROSPACE ENGINEERING

MOTORS, PARTICLES, PHASE, PRESSURE, PROBES, RECIRCULATION,  
REGIONS, TEMPERATURE, TEST AND EVALUATION, WATER.

(U) Liquid Motor Combustion Stability Using Coaxial  
Injectors.

DESCRIPTIVE NOTE: Final rept. 1 Oct 91-31 Dec 92,

APR 93 12P

PERSONAL AUTHORS: Micci, Michael M.

CONTRACT NO. F49620-92-J-0042

MONITOR: AFOSR, XC  
TR-94-0322, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The Final Report documents the first fifteen months of work on an experimental investigation of the sources of combustion instability in liquid propellant rocket motors using coaxial injectors. Three possible contributions to combustion instability are being investigated: atomization characteristics, flameholding by means of a recirculation region at the base of the LOX post and gas side injector coupling. The atomization is characterized by means of a Phase Doppler Particle Analyzer (PDPA). Initial results are presented for a full size SSME preburner injector operating with water and air at atmospheric pressure. Future experiments are planned using either liquid nitrogen or liquid oxygen with either nitrogen or helium as the simulant gas at chamber pressures up to 10 MPa. In order to simulate the hydrogen temperature ramping test, a liquid nitrogen heat exchanger to cool the simulant gas has been designed and is under construction. An LDV system has been assembled to probe the region at the base of the LOX post to determine if a recirculation region exists there and if so to measure its strength. Combustion instability, Liquid rocket motors, Coaxial injectors, Phase Doppler Particle Analyzer.

DESCRIPTORS: (U) \*COMBUSTION, \*LIQUID PROPELLANT ROCKET ENGINES, \*INSTABILITY, ANALYZERS, ATMOSPHERICS, ATOMIZATION, BAROMETRIC PRESSURE, CHAMBERS, CONSTRUCTION, COUPLINGS, HEAT EXCHANGERS, HELIUM, HYDROGEN, INJECTORS, LIQUID NITROGEN, LIQUID OXYGEN, LIQUID PROPELLANTS,

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DISPLAYTECH INC BOULDER CO

(U) Development of Ferroelectric Liquid Crystals with Enhanced Nonlinear Optical Properties.

DESCRIPTIVE NOTE: Final rept. 15 Jul 93-15 Apr 94,

APR 94 26P

second-order nonlinear susceptibility. Ferroelectric liquid crystal, Second-order nonlinear optical material.

DESCRIPTORS: (U) \*FERROELECTRIC CRYSTALS, \*NONLINEAR OPTICS, \*ELECTROOPTICS, CRYSTALS, FREQUENCY, GLASS, LIQUID CRYSTALS, MODULATION, NITROBENZENES, OPTICAL MATERIALS, PHASE, POLARIZATION, POLYMERS, SYNTHESIS, TEMPERATURE, OPTICAL PROPERTIES.

PERSONAL AUTHORS: Arnett, Kenneth E.

REPORT NO. DTI-158F

CONTRACT NO. F49620-93-C-0045

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-0324, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During our Phase I research, we advanced materials synthesis and evaluation techniques needed to develop ferroelectric liquid crystals into a useful second-order nonlinear optical material. We developed a technique for determining the second-order nonlinear susceptibility by measuring the electro-optic coefficient  $r_{22}$  at 633 nm, using modulation frequencies between 100 KHz-100 MHz. We evaluated two specially synthesized FLCs by measuring their  $r_{22}$  coefficients: previously existing MX-5679 and recently synthesized W-399, both based on a nitrobenzene hyperpolarizable moiety. Results show an increasing  $r_{22}$  with increasing spontaneous polarization. We also partially evaluated a new FLC material, W-371, with an ortho-situated nitroaniline hyperpolarizable moiety. Since the liquid crystalline and the linear and nonlinear materials parameters FLCs have a temperature dependence, we examined existing FLC polymers for a FLC to glass phase and discovered a polymeric/FLC system that potentially could be used to reduce temperature dependent materials properties. Our FLC synthesis efforts concentrated on synthesis of Hoffman-LaRoche compounds roche 1 and roche 2. Unfortunately, we were unable to duplicate their synthesis and instead developed an alternative core that could yield FLCs with a higher

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PHYSICAL OPTICS CORP TORRANCE CA

(U) Polymer Based All-Optic Reconfigurable Interconnects.

DESCRIPTIVE NOTE: Final rept. 1 Jul-31 Dec 93,

FEB 94 45P

PERSONAL AUTHORS: Jannson, Tomasz

CONTRACT NO. F49620-93-C-0046

PROJECT NO. 1602

TASK NO. 01

MONITOR: AFOSR, XC  
TR-94-0313, AFOSR

interconnect.

DESCRIPTORS: (U) \*POLYMERS, \*RADIATION HARDENING,  
\*OPTICAL SWITCHING, \*PHOTOPLASTIC MATERIALS, CHANNELS,  
COSTS, CROSSBAR SWITCHES, DATA RATE, GEOMETRY, HARDENING,  
LOW POWER, OPTICS, POWER, PROTOTYPES, WAVEGUIDES,  
COMMUNICATIONS NETWORKS, BIREFRINGENCE, OPTICAL  
WAVEGUIDES.

IDENTIFIERS: (U) WUAFOSR160201, PE63218C.

#### UNCLASSIFIED REPORT

**ABSTRACT:** (U) In Phase I of this project, POC successfully implemented a prototype all-optic reconfigurable polymer-based crossbar switch. POC's all-optic reconfigurable polymer-based crossbar switch represents a unique combination of polymer techniques, simple geometry optics, and waveguide technology. These three essential technologies are original POC developments. POC's crossbar switch will provide reconfigurability, large fan-out, and radiation hardening. This is a new technology for both parallel and distributed processing and communication networks. The Phase I results have shown that POC's crossbar switch can offer a number of important advantages not achievable by either electronic interconnects or currently existing all-optic reconfigurable interconnects. These advantages include: (1) very low power sources (~100 mW), (2) relatively high interconnect reconfigurability time, (3) high data rates over 1 Gb/sec, (4) low bit error rate (< 10<sup>-10</sup>), (5) very large fan-out capability (< 1000 channels), (6) very low manufacturing cost, and (7) very high erasability. It is expected that POC's crossbar switch performance will be superior to existing electronic and optical interconnection approaches. In Phase I, POC also demonstrated the feasibility of commercialization in the area of multimedia, video conferencing, and other communication applications. Crossbar switch, Birefringent photopolymer, Optical

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CHARLES RIVER ANALYTICS INC CAMBRIDGE MA

(U) A Neural Expert Approach to Self Designing Flight Control Systems.

DESCRIPTORS: (U) \*FLIGHT CONTROL SYSTEMS, AIRCRAFT, ARCHITECTURE, CONTROL, DYNAMICS, ERRORS, FORMULATIONS, LEARNING, LOOPS, NETWORKS, NEURAL NETS, NONLINEAR SYSTEMS, PARAMETERS, PHASE, REAL TIME, RELIABILITY, SIMULATION, STABILITY, TEST AND EVALUATION, TIME.

DESCRIPTIVE NOTE: Final rept. 15 Jul 93-14 Jan 94,

APR 94 70P

PERSONAL AUTHORS: Botros, Sherif M.; Caglayan, Alper K.; Zacharias, Greg L.

REPORT NO. R93081

CONTRACT NO. F49620-93-C-0050

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-0310, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Based on the simulations performed in this phase I study, we show that Hopfield and RBF feedforward network architectures may have a great potential in the control of nonlinear systems. In particular, Hopfield implementation of Lagrange multiplier method is suitable for real-time adaptive optimal control. Similarly, RBF feedforward neural network architectures are suitable for learning inverse dynamics and inverse trim in aircraft FCS applications. In addition, RBF feedforward are easier to train than backpropagation sigmoid networks since RBF formulation results in linear parameters. The initial simulations we performed show very promising results as exemplified by the small control errors in closed-loop simulations using the nonlinear /A-18 longitudinal dynamics. Further studies are needed to test the applicability of the techniques to real world problems and to study the robustness, stability and general reliability of the proposed neural techniques. Neural networks by themselves cannot be the panacea to all the nonlinear control problems. An effort has to be made to incorporate all the available knowledge about the dynamics system to achieve good performance.

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UTAH STATE UNIV LOGAN CENTER FOR ATMOSPHERIC AND SPACE  
SCIENCES

VELOCITY, DRIFT, GRAVITY WAVES, INCOHERENT SCATTERING,  
ATMOSPHERIC SCATTERING, DOPPLER RADAR.

(U) Analysis of Mesospheric Winds and Waves. IDENTIFIERS: (U) WUAFOSR2310CS, PE61102F.

DESCRIPTIVE NOTE: Final rept. 1 Sep 93-31 Dec 93,

MAY 94 42P

PERSONAL AUTHORS: Miller, Kent L.; Roper, Robert G.

CONTRACT NO. F49620-93-1-0460

PROJECT NO. 2310

TASK NO. CS

MONITOR: AFOSR: XC  
TR-94-0340, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During the four months this grant was operative, a paper expanding on the Arecibo Initiative in Dynamics of the Atmosphere (AIDA '89) incoherent scatter/imaging Doppler interferometry (ISR/IDI) radar comparisons, which used revised data from both techniques, was prepared, and has subsequently been submitted and accepted for publication in the Journal of Atmospheric and Terrestrial Physics. In this paper, 'Mesospheric Wind Studies During AIDA Act '89: Morphology and Comparison of Various Techniques,' by R. S. Turek, K. L. Miller, R. G. Roper and J. W. Brosnahan, all of the measured line of sight velocity profiles for which data was available from both techniques, rather than a few selected profiles as previously analyzed, were subjected to a statistical analysis. This resulted in comparison of over 200 profiles, ten times more than the 20 previously published. After establishing that the sum of the prevailing wind, diurnal and semidiurnal tides deduced from the IDI data represented the statistical mean of the ISR data, we determined the morphology of the prevailing winds and tides over Arecibo during the April and May AIDA campaigns. The results are presented in this report.

DESCRIPTORS: (U) \*RADAR, \*WIND, \*MESOSPHERE,  
\*ATMOSPHERIC MOTION, INTERFEROMETRY, LINE OF SIGHT,  
MORPHOLOGY, PROFILES, STATISTICAL ANALYSIS, TIDES,

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YALE UNIV NEW HAVEN CT

previously developed fluorescence imaging techniques to allow simultaneous vector and scalar imaging in turbulent flames, and (4) Development of new mixture fraction imaging techniques for studying turbulent nonpremixed hydrocarbon flames. Multicomponent droplets, Nonlinear optical effect, Lasing, Stimulated Raman scattering, Evaporation, Shape distortion, Interacting droplets, Particle image velocimetry, Flow and flame imaging, Laser diagnostics, Mixture fraction.

(U) Nonlinear Spectroscopy of Multicomponent Droplets and Two- and Three Dimensional Measurements in Flames.

DESCRIPTIVE NOTE: Final technical rept. 1 Feb 91-31 Jan 94,

MAR 94 36P

PERSONAL AUTHORS: Chang, Richard K.; Long, Marshall B.

CONTRACT NO. AFOSR-91-0150

PROJECT NO. 2308

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0320, AFOSR

DESCRIPTORS: (U) \*FLAMES, \*NONLINEAR OPTICS, \*DROPS, CHEMICALS, COMBUSTION, DETECTION, DIFFUSION, DISTORTION, EVAPORATION, FLOW, FLUORESCENCE, HYDROCARBONS, IMAGES, INTERACTIONS, LASERS, LIQUIDS, MAPPING, MEASUREMENT, MIXTURES, MODELS, PARTICLES, PHYSICAL PROPERTIES, RAYLEIGH SCATTERING, SCATTERING, SEEDING, SHAPE, SPECTROSCOPY, SPRAYS, THREE DIMENSIONAL, TURBULENT FLOW, VELOCITY, TWO DIMENSIONAL, COMBUSTORS, TURBULENCE, RAMAN SPECTROSCOPY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2308CS,  
\*Multicomponent droplets, PIV(Particle Image Velocimetry), Lasing.

UNCLASSIFIED REPORT

ABSTRACT: (U) Significant progress has been made in the following two research areas: I Nonlinear spectroscopy of micron-sized multicomponent droplets; and II. Two- and three-dimensional scalar and velocity mapping. I. Chemical species and physical properties of multicomponent liquid droplets in a spray combustor can be determined by a nonintrusive in-situ optical diagnostics techniques. A brief summary of the research accomplishments in the three areas related to the nonlinear optical interactions inside micron-sized droplets and the applications of such spectroscopy to determine the chemical and physical properties of the droplets: (1) Model for Nonlinear Optical Processes in Droplets, (2) Fluorescence Seeding of Simulated Raman Scattering (SRS) of the Minority Species, and (3) Detection of Slight Shape Distortion by Spectroscopic Means. II. A review of the progress in our multidimensional scalar and velocity measurements in turbulent flames is also given. Among the accomplishments during the funding period are the following: (1) Scalar field measurements of differential diffusion effects in turbulent flows; (2) Development of a digital particle image velocimetry (PIV) technique for velocity field measurements in reacting and nonreacting flows; (3) Combination of the new digital PIV technique with

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FLORIDA STATE UNIV TALLAHASSEE DEPT OF METEOROLOGY

WASHINGTON UNIV ST LOUIS MO

(U) Prediction of Global Cloud Cover with a Very High Resolution Global Spectral Model.

(U) Theory and Applications of the Phi Transform Wavelets.

DESCRIPTIVE NOTE: Final rept. 15 Nov 90-14 Feb 94,

DESCRIPTIVE NOTE: Final rept. 1 Jul 90-31 Dec 93,

DEC 93 12P

MAY 94 115P

PERSONAL AUTHORS: Krishnamurti, T. N.

PERSONAL AUTHORS: Weiss, Guido

CONTRACT NO. AFOSR-91-0023

CONTRACT NO. AFOSR-90-0323

PROJECT NO. 2310

PROJECT NO. 9808

TASK NO. A1

TASK NO. 05

MONITOR: AFOSR, XC

MONITOR: AFOSR, XC

TR-94-0334, AFOSR

TR-94-0327, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

**ABSTRACT:** (U) The completed research is in the area of cloud prediction with a high resolution global model. We have extended our studies on the handling of implicit clouds (i.e. clouds specified as a function of prevailing humidity). We have also examined this problem in the context of rainfall initialization (called physical initialization). We demonstrate a strong positive impact on cloud forecasts from such an initialization. We have also made a start on the problem of explicit cloud forecasts using cloud water mixing ratio and cloud fractions as basic forecast variables. Our preliminary results, described in the final report, are very encouraging. Mannoji (1994) has in fact noted a slight superiority of the explicit over the implicit scheme. That work was performed using a low resolution global model. Further work on the improvement of the explicit scheme at higher resolution is required. Cloud prediction, Global modelling of clouds.

**DESCRIPTORS:** (U) \*CLOUD COVER, CLOUDS, FUNCTIONS, GLOBAL, HANDLING, HIGH RESOLUTION, HUMIDITY, IMPACT, LOW RESOLUTION, MIXING, MODELS, PREDICTIONS, RAINFALL, RATIOS, VARIABLES, WATER, WORK, FORECASTING.

**IDENTIFIERS:** (U) PES1102F, WUAFOSR2310A1.

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**ABSTRACT:** (U) A fundamental idea in Fourier analysis is that the Fourier Transform gives a simultaneous diagonalization of a small but very important class of operators including differentiation and integration. On the other hand, the Fourier Transform is not well suited for studying Multiplication operators. The wavelet transform (and related transforms give excellent simultaneous almost diagonalization of a very large class of operators which includes differentiation, integration, and multiplication: in fact, more-generally singular integral operators and pseudo-differential operators. Professor Rochberg's recent work has been to use this fact to study such operators. Some work has been in the real variable tradition, other parts have involved operators on spaces of analytic functions.

**DESCRIPTORS:** (U) \*FOURIER ANALYSIS, \*OPERATORS(MATHEMATICS), ANALYTIC FUNCTIONS, MATRICES(MATHEMATICS), INTEGRALS, INTEGRATION, MULTIPLICATION, REAL VARIABLES, FOURIER TRANSFORMATION, KERNEL FUNCTIONS, SCHRÖDINGER EQUATION, COMPLEX VARIABLES.

**IDENTIFIERS:** (U) WUAFOSR980805, \*Wavelets, Diagonalization.

## UNCLASSIFIED

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AD-A279 912 9/5

PURDUE UNIV LAFAYETTE IN SCHOOL OF MECHANICAL  
ENGINEERING

IBM ALMADEN RESEARCH CENTER SAN JOSE CA

(U) Aero-Thermodynamic Distortion Induced Structured  
Dynamic Response.

(U) Time Domain Spectral Hole-Burning Storage.

DESCRIPTIVE NOTE: Final rept. 1 Jun 91-31 Dec 93.

DESCRIPTIVE NOTE: Final rept. 1 Jun 91-31 Dec 93.

MAY 94 101P

MAY 94 18P

PERSONAL AUTHORS: Fleeter, Sanford

PERSONAL AUTHORS: Jefferson, Michael

CONTRACT NO. AFOSR-91-0251

CONTRACT NO. F49620-92-C-0068

PROJECT NO. 2307

MONITOR: AFOSR, XC  
TR-94-0312, AFOSR

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0338, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

ABSTRACT: (U) This final report summarizes the results obtained on Grant AFOSR-91-025. The overall objective of this basic research program was the quantitative investigation of the fundamental phenomena relevant to aero-thermodynamic distortion induced structural dynamic blade responses in multistage gas turbine engines and the study of the fundamental unsteady aerodynamics and heat transfer phenomena inherent in turbines. The technical approach involved unique benchmark experiments and also analyses. In particular, the flow physics of multistage blade row interactions were investigated, with unique unsteady aerodynamic data obtained and analyses developed to understand, quantify, and discriminate the fundamental flow phenomena as well as to direct the modeling of advanced analyses.

DESCRIPTORS: (U) \*GAS TURBINES, \*AEROTHERMODYNAMICS, AERODYNAMICS, BLADES, DISTORTION, ENGINES, HEAT TRANSFER, INTERACTIONS, TURBINES, STRUCTURAL RESPONSE, UNSTEADY FLOW, FLOW SEPARATION, MATHEMATICAL MODELS, INLET GUIDE VANES, ACOUSTIC RESONANCE, WAKE, GUST LOADS, AIRFOILS.

IDENTIFIERS: (U) WUAFOSR2307DS, PE81102F.

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AD-A279 912

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ABSTRACT: (U) This work achieved several substantial results. A highly stabilized laser system suitable for many detailed studies of data storage phenomena was constructed and made to work. This laser was essential for the investigations which followed. Using the stabilized laser, a real time correlator was demonstrated, which correctly identified all occurrences of a test sequence imbedded in random data. This correlator is the first demonstration of the use of phase modulation to store and retrieve data in time domain hole-burning. In the frequency domain, narrow holes were burned and scanned, and information storage at a spectral density exceeding 50,000 bits per spot was demonstrated, with perfect recall and excellent signal to noise. We have also made the first demonstration of a novel technique for storing and retrieving phase modulated data streams with time domain spectral hole-burning. This demonstration has been disclosed for patent purposes.

DESCRIPTORS: (U) \*TIME DOMAIN, \*OPTICAL STORAGE, COMBUSTION, CORRELATORS, DEMONSTRATIONS, DENSITY, FREQUENCY, FREQUENCY DOMAIN, LASERS, MODULATION, NOISE, PATENTS, PHASE MODULATION, REAL TIME, RECALL, SEQUENCES, SIGNALS, STORES, TEST AND EVALUATION, TIME, BURNING RATE, DATA STORAGE SYSTEMS, DOPING, RARE EARTH ELEMENTS.

IDENTIFIERS: (U) \*Hole burning, \*Stabilized lasers.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A279 909 CONTINUED

AD-A279 909 12/9 17/9 17/1  
DARTMOUTH COLL HANDOVER NH DEPT OF MATHEMATICS  
(U) Applications of Wavelets to Radar, Imaging and Related Problems.

PROPAGATION, NONDESTRUCTIVE TESTING, MAXIMUM LIKELIHOOD ESTIMATION, REMOTE DETECTION, FAST FOURIER TRANSFORMS, COMPUTER AIDED DESIGN, COMPUTER AIDED MANUFACTURING, VELOCIMETERS.

DESCRIPTIVE NOTE: Final rept. 1 Jul 90-30 Sep 93.

IDENTIFIERS: (U) Remote sensing, Wavelets

SEP 93 14P

PERSONAL AUTHORS: Prosser, Reece; Healy, Dennis M., Jr

CONTRACT NO. AFOSR-90-0292

PROJECT NO. 9806

TASK NO. 07

MONITOR: AFOSR, XC  
TR-94-0333, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) A primary concern of this study has been waveform design for active inverse problems of acoustic and electromagnetic variety. We developed several useful results in the specific areas of electromagnetic and acoustic bullets, signal design for doppler ultrasound velocimetry and magnetic resonance imaging, and limited data tomography problems arising in medical imaging and in radar. Another area of proposed research involved the construction of maximum likelihood receivers for various novel signal sources, such as those arising in particular wideband acoustic data, and image data from non-euclidean sources. We have developed efficient algorithms in both of these regimes. In particular, we have studied receivers for application to wideband acoustic signal processing in acoustic velocimetry for the dense target environments occurring in Doppler ultrasound problems, and computationally efficient matched filter processor for the sphere. This has direct application to directional data of various forms, with applications from remote sensing problems to quality assurance for CAD/CAM.

DESCRIPTORS: (U) \*RADAR, \*SONAR, \*IMAGE PROCESSING, \*ACOUSTIC IMAGES, ACOUSTIC DATA, ACOUSTIC SIGNALS, ALGORITHMS, IMAGES, MAGNETIC RESONANCE, MATCHED FILTERS, QUALITY ASSURANCE, RECEIVERS, SIGNAL PROCESSING, SIGNALS, TARGETS, TOMOGRAPHY, WAVEFORMS, ELECTROMAGNETIC WAVE

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AD-A279 907 4/2 4/1

COLORADO UNIV AT BOULDER DEPT OF ASTROPHYSICAL PLANETARY  
AND ATMOSPHERIC SCIEN CES

IDENTIFIERS: (U) PEB1103D, Frontogenesis, Geostrophy

(U) Front-Boundary Layer Models from STORM-FEST  
Observations.

DESCRIPTIVE NOTE: Annual rept. 1 Jun 93-31 May 94,

MAY 94 8P

PERSONAL AUTHORS: Blumen, William

CONTRACT NO. F49620-93-1-0418

PROJECT NO. 3484

TASK NO. YS

MONITOR: AFOSR, XC  
TR-94-0318, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The STORM-FEST field campaign to investigate atmospheric frontal structure and evolution provided data on deformation frontogenesis observed 20-21 February 1992. These data have been analyzed, and the principal features compared with the theoretical predictions of a semi-geostrophic inviscid, adiabatic model. The overall agreement is good, although viscous and thermal diffusion in the planetary boundary layer is omitted from the theoretical model. The relative importance of terms neglected in the semi-geostrophic model, including ageostrophic accelerations, viscous and nonadiabatic contributions will be evaluated during the second year of the investigation. Modification of the theory to include neglected effects will be attempted to improve low-level predictions of frontogenesis. Completion by May 31, 1995 is anticipated. STORM-FEST Field program, Atmospheric frontogenesis deformation frontogenesis, Semi-geostrophic theory of frontogenesis, Boundary layer in frontogenesis.

DESCRIPTORS: (U) \*BOUNDARY LAYER, \*ATMOSPHERE MODELS, \*FRONTS(METEOROLOGY), ACCELERATION, ATMOSPHERICS, DEFORMATION, DIFFUSION, LOW LEVEL, MODIFICATION, PREDICTIONS, STORMS, THEORY, THERMAL DIFFUSION, WEATHER FORECASTING.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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AD-A279 908 21/2 21/4

IOWA UNIV IOWA CITY DEPT OF MECHANICAL ENGINEERING

(U) Heat Transfer, Fouling, and Combustion of Supercritical Fuels.

TRANSFER, \*JET FLAMES, ATOMIZATION, DIFFUSION, SUPERCRITICAL FLOW, INJECTION, VORTEX SHEDDING, QUALITATIVE ANALYSIS, INJECTORS, INTERACTIONS, LIGHT SCATTERING, FUEL AIR RATIO, FLOW VISUALIZATION, MIST, MIXING, MIXTURES, VAPOR PHASES.

DESCRIPTIVE NOTE: Final rept. 15 Aug 92-31 Mar 94,

IDENTIFIERS: (U) PEG1102F, Supercritical fuels.

APR 94 67P

PERSONAL AUTHORS: Chen, L. D.

CONTRACT NO. F49620-92-J-0462

PROJECT NO. 2308

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0321, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) The specific objectives of the project were to investigate the dynamics of the vortex and flame interaction in jet diffusion flames and the transport phenomena associated with the injection of supercritical fluids into a sub-critical environment. The vortex-flame interaction in a near-laminar jet diffusion flame was quantified by a planar visualization and the vortex formation in a transitional jet diffusion flame by a line visualization. The measured vortex crossing frequency in transitional jet diffusion flames was used to verify the time-dependent diffusion flame calculations. The experiments also quantified the spray length in two different ambient environments composed of dissimilar species. The mixture pseudo-critical states were calculated for the conditions examined. The spray length, the calculated mixture pseudo-critical states, along with images of instantaneous light scattering and shadowgraph showed that the mixing of dense fluids dictated the spread of mist-like droplets and vapor-phase injector fluid. The supercritical sprays also exhibited flashing-like atomization as concluded from the experiments. Further investigation on the mixing in the super-critical sprays was suggested. Combustion, Jet diffusion flames, Sprays, Supercritical sprays.

DESCRIPTORS: (U) \*COMBUSTION, \*FUEL SPRAYS, \*HEAT

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AD-A279 905 12/7 12/5 13/8 DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J  
AD-A279 905 CONTINUED

GEORGIA INST OF TECH ATLANTA SCHOOL OF INDUSTRIAL AND  
SYSTEMS ENGINEERING SYSTEMS ANALYSIS.

(U) Stochastic Network Processes.

DESCRIPTIVE NOTE: Final rept. 1 Nov 90-31 Oct 93,

OCT 93 8P

PERSONAL AUTHORS: Serfozo, Richard

CONTRACT NO. AFOSR-91-0013

PROJECT NO. 2304

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0309, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The general theme of the research has been to develop stochastic network processes for modeling the movement of discrete units in networks. Primary examples are the movement of parts and supplies in manufacturing plants and in distribution systems and the movement of data packets and telephone calls in computer and telecommunications networks. The distinguishing feature of the research is the emphasis on the next generation of intelligent networks that will be the backbone of the manufacturing and computer systems. In these networks, the processing of units at the nodes and the routing of units typically depend dynamically on the actual network congestion, and units move concurrently (e.g. batch processing) most of the present theory of stochastic network processes is for unintelligent networks in which the nodes operate independently, the routes of units are independent, and the units move one-at-a-time. The goal is to provide an understanding of these more complex intelligent networks by describing their stochastic behavior.

DESCRIPTORS: (U) \*COMPUTER NETWORKS, \*QUEUEING THEORY, BATCH PROCESSING, CONGESTION, PARALLEL PROCESSING, DISTRIBUTION, INDUSTRIAL PLANTS, MANUFACTURING, STOCHASTIC PROCESSES, NODES, ROUTING, TELECOMMUNICATIONS, DISTRIBUTED DATA PROCESSING, TIME, CONTROL THEORY,

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## DTIC REPORT BIBLIOGRAPHY

SEARCH CONTROL NO. T4P42J

AD-A279 898 5/8

DREXEL UNIV PHILADELPHIA PA DEPT OF ELECTRICAL AND  
COMPUTER ENGINEERING(U) Designing the Architecture of Hierarchical Neural  
Networks Model Attention, Learning and Goal-Oriented  
Behavior.

DESCRIPTIVE NOTE: Final rept. 1 Nov 88-31 Dec 93,

DEC 93 23P

PERSONAL AUTHORS: Guez, Allon

CONTRACT NO. AFOSR-89-0010

PROJECT NO. 2304

TASK NO. HS

MONITOR: AFOSR, XC  
TR-94-0329, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) During this period this grant partially supported 6 researchers, and resulted in over 21 publications. This unusually large activity is largely due to the enthusiasm of the researchers and their institution, Drexel University, which indirectly carried some of the financial burden. Neural or other learning architecture for real world, real time applications, necessarily employ feedback and thus deal with the unavoidable dilemma of identification versus stabilization or tracking. The major finding reported focuses on this tradeoff and how to optimally perform it. For linear time invariant finite dimensional systems they are able to perform on-line closed loop identification and tracking. If in addition the learning and tracking cost functions are quadratic they show these costs may be linearly scalarized without loss of optimality.

DESCRIPTORS: (U) \*ATTENTION, \*BEHAVIOR, \*NETWORKS, \*LEARNING, \*NEURAL NETS, ARCHITECTURE, COSTS, FEEDBACK, FINANCE, FUNCTIONS, GRANTS, IDENTIFICATION, LOOPS, REAL TIME, STABILIZATION, TIME, TRACKING, UNIVERSITIES.

IDENTIFIERS: (U) WUAFOSR2304HS.

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AD-A279 897 12/5

MASSACHUSETTS UNIV AMHERST DEPT OF COMPUTER AND  
INFORMATION SCIENCE(U) Case-Based Reasoning in Mixed Paradigm Settings and  
with Learning.

DESCRIPTIVE NOTE: Final rept. 15 Sep 90-28 Feb 94,

APR 94 14P

PERSONAL AUTHORS: Rissland, Edwina L.

CONTRACT NO. AFOSR-90-0359

PROJECT NO. 7518

TASK NO. 05

MONITOR: AFOSR, XC  
TR-94-0326, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) In this project we investigated: (1) CBR in mixed paradigm settings, in particular in a blackboard-based system, called FRANK, that generated various types of explanations and arguments where supporting tasks, such as case-and rule-based reasoning, were dynamically configured to reflect the user's intended purposes for the report; (2) pure CBR, particularly issues concerning the use of multiple indices and types of case representations, in a system called BankXX, that used classic heuristic best-first search to retrieve information needed for case-based argument; and (3) the application of machine learning techniques to core issues in CBR, such as the problems of learning indices and prototype cases and estimating concept theory drift.

DESCRIPTORS: (U) \*TAXONOMY, \*HEURISTIC METHODS, DRIFT, LEARNING, PROTOTYPES, REASONING, THEORY, INFORMATION RETRIEVAL.

IDENTIFIERS: (U) WUAFOSR751805, \*Case based systems, FRANK(Flexible Report and Analysis System), GBB(Generic Blackboard Development), BankXX Computer program

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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AD-A279 896 12/8 12/5

TEXAS ENGINEERING EXPERIMENT STATION COLLEGE STATION

COMPUTATIONS, FAULTS, LIBRARIES, MODELS,  
RELIABILITY(ELECTRONICS), TRADE OFF ANALYSIS, COMPUTER  
ARCHITECTURE, COMPUTER AIDED DIAGNOSIS.

(U) Fault-Tolerance in Distributed and Multiprocessor Real-  
Time Systems.

IDENTIFIERS: (U) WJAFOSR2304FS, REACT(Reliable  
Architecture Characterization Tool).

DESCRIPTIVE NOTE: Final rept. 1 Sep 92-31 Aug 93,

AUG 93 41P

PERSONAL AUTHORS: Pradhan, Dhiraj K.

CONTRACT NO. F49620-92-J-0383

PROJECT NO. 2304

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0330, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) New schemes for fault-tolerance in multiprocessor and distributed systems have been developed in the following areas: We have investigated a number of fault tolerance schemes to evaluate performance, reliability, and availability trade-offs. Fault tolerance schemes are being developed for various fault models (tail-stop model, fail-slow model, and arbitrary failure model) and application areas (applications that are to provide results at the end of computation and applications that are long-running but should also provide results during computation). In the area of software-implemented fault tolerance, we are studying approaches for providing user transparent mechanisms for fault tolerance to design and implement a software library to which the user can link existing application software to achieve the desired level of fault tolerance. We are developing a new tool (Reliable Architecture Characterization Tool--REACT) for evaluating the reliability and availability of distributed multiprocessor systems using various fault tolerance techniques. This tool will facilitate evaluation of the fault tolerance schemes that we develop.

DESCRIPTORS: (U) \*SYSTEMS ANALYSIS, \*SOFTWARE  
ENGINEERING, \*FAULT TOLERANCE, \*MULTIPROCESSORS,  
\*DISTRIBUTED DATA PROCESSING, AVAILABILITY, COMMERCE,

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NEW YORK UNIV NY COURANT INST OF MATHEMATICAL SCIENCES

ENERGY, HEAT, INSTABILITY, FLOW FIELDS, COMPUTERIZED  
SIMULATION, BOUNDARY LAYER, MAGNETIC FIELDS, PHOTOSPHERE,  
MAGNETIC RESONANCE, HALL EFFECT, STABILITY, THREE  
DIMENSIONAL, TWO DIMENSIONAL.

(U) Solar Flare MDH.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2311AS, Magnetic  
reconnection, Ballooning modes.

DESCRIPTIVE NOTE: Annual rept. 1 Jan-31 Dec 93,

DEC 93 9P

PERSONAL AUTHORS: Strauss, H.; Hameiri, E.

CONTRACT NO. AFOSR-91-0044

PROJECT NO. 2311

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0315, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During the past year, several topics were studied which are important for solar MHD. These include: 3D coalescence instability and magnetic reconnection. Magnetic reconnection is fairly well understood in two dimensional theory and numerical simulations in which there is an ignorable coordinate. It is poorly understood in three dimensional line tied magnetic fields, which are the generic case in solar flux loops. The 3D line tied coalescence MHD instability was investigated both analytically and numerically. In the nonlinear stages of the simulation, the instability drives magnetic reconnection. As in earlier 3D forced reconnection simulations, an intense current layer forms where magnetic energy is converted to heat. It was found that while line tying somewhat inhibits reconnection, it does not prevent it. Line tied gravitational ballooning instability. A new two dimensional prominence model was found and its stability was analyzed. This instability might describe the irregular rain falling from prominences. Boundary conditions for the solar corona. It has been the practice to model the effects of the chromosphere and photosphere only through their influence on the boundary conditions imposed at the base of the corona.

DESCRIPTORS: (U) \*SOLAR FLARES, \*MAGNETOHYDRODYNAMICS,  
\*SOLAR CORONA, CHROMOSPHERE, COALESCENCE, COORDINATES,

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MARYLAND UNIV COLLEGE PARK DEPT OF MATHEMATICS

MASSACHUSETTS INST OF TECH CAMBRIDGE RESEARCH LAB OF ELECTRONICS

(U) Higher Order Crossings.

(U) Analog Processing of Optical Wavefront Using Integrated Guided-Wave Optics.

DESCRIPTIVE NOTE: Final rept. 1 Oct 88-30 Sep 93,

SEP 93 7P

DESCRIPTIVE NOTE: Final rept. 1 Jun 90-31 Dec 93,

PERSONAL AUTHORS: Kadem, Benjamin

MAR 94 55P

CONTRACT NO. AFOSR-89-0049

PERSONAL AUTHORS: Rediker, Robert H.

PROJECT NO. 2304

CONTRACT NO. F49620-90-C-0036

TASK NO. A5

PROJECT NO. 3151

MONITOR: AFOSR, XC  
TR-94-0304, AFOSR

TASK NO. 00

MONITOR: AFOSR, XC  
TR-94-0306, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) Progress in the higher order crossings (HOC) method included development of 'contraction mapping' for the estimation of discrete frequencies in noise. Parametric filters allow the estimates to attain high precision. Reports and papers on this technique are listed, and applications to the discrimination of metal plates has begun.

DESCRIPTORS: (U) \*CROSSINGS, \*FREQUENCY, \*GAUSSIAN NOISE, \*ACOUSTIC FILTERS, ESTIMATES, PARAMETRIC ANALYSIS, METAL PLATES, PRECISION, TIME SERIES ANALYSIS, THRESHOLD EFFECTS, AUTOCORRELATION, STOCHASTIC CONTROL.

IDENTIFIERS: (U) WUAFOSR2304A5, HOC(High Order Crossing), \*Contraction mapping, Zero crossing.

ABSTRACT: (U) Integrated Guided-Wave Optics has many advantages for the analog processing of optical wavefronts. These include small-size, high-speed, simplicity, reliability and reproducibility. The fabrication technique is similar to that of integrated circuits. The thrust of this program was to develop an integrated guide-wave optic system in GaAs and GaAlAs for use at GaAs laser wavelength, to remove aberrations from a laser beam and to steer the beam. The system would in addition have the capability to appropriately phase the outputs from a multiplicity of power amplifiers or injection locked lasers. It was also the intent of the program to design and build the optical circuits so they are compatible with on-chip electronic circuits in order to minimize the required number of off-chip leads

DESCRIPTORS: (U) \*OPTICS, \*WAVEFRONTS, \*ANALOG SYSTEMS, \*LASER BEAMS, WAVEGUIDES, PROCESSING, GALLIUM ARSENIDES, FABRICATION, ALUMINUM, POWER AMPLIFIERS, CIRCUITS, CHIPS(ELECTRONICS), ELECTROOPTICS, TITANIUM, LITHIUM, NIOBIUM, OXIDES, SEMICONDUCTORS, INTERFEROMETERS, INJECTION LASERS.

IDENTIFIERS: (U) WUAFOSR315100, \*Guided-wave devices.

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK

POLARIZATION, PROFILES, REGIONS, SOLID SOLUTIONS, TRANSDUCERS, VOLUME, WIDTH, GRADIENTS, DISPERSIONS, SURFACES, HOLOGRAPHY, MICROSTRUCTURE, MODULATION, COUPLINGS, EULER EQUATIONS.

(U) Domain Processes in Ferroelectric Ceramics:

DESCRIPTIVE NOTE: Final rept. 30 Sep 91-31 Dec 93,

APR 94 78P

IDENTIFIERS: (U) Smart structures, Nonlocal coupling, Morphotropic.

PERSONAL AUTHORS: Cao, Wenwu; Cross, L. E.

CONTRACT NO. AFOSR-91-0433

MONITOR: AFOSR, XC  
TR-94-0308, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report outlines the progress achieved during a two year effort sponsored by the AFOSR on the theoretical study of domain and domain wall formation in ferroelectrics. Understanding on domain formation and domain dynamics in ferroelectrics are crucial for developing better functional ceramic materials for transducers and actuators. A continuum model has been developed to describe the polarization profile in ferroelectrics, which takes into account both nonlinear and nonlocal nature of the ferroelectric system. The theory can give rise to twin and twin band solutions under proper boundary conditions. A theoretical model is also developed for the morphotropic phase boundary in PZT system, which provides a new interpretation on the phase coexistence in a complete solid solution system. According to the new definition, the width of the coexistence region is inversely proportional to the volume of the coherent region, such as the particle size for a fine grain system. Theoretical interpretation is provided to the electron interference pattern across a ferroelectric domain wall in holographic electron microscopy, a newly developed technique with much higher magnification than the conventional TEM. The relationship between microscopic lattice dynamics and the continuum theory is also established.

DESCRIPTORS: (U) \*CERAMIC MATERIALS, \*DOMAIN WALLS, \*FERROELECTRIC MATERIALS, ACTUATORS, BOUNDARIES, DYNAMICS, ELECTRON MICROSCOPY, ELECTRONS, FERROELECTRIC DOMAINS, FINES, INTERFERENCE, LATTICE DYNAMICS, MAGNIFICATION, MATERIALS, MODELS, PARTICLE SIZE, PATTERNS, PHASE,

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UNIVERSITY OF SOUTHERN CALIFORNIA LOS ANGELES DEPT OF  
ELECTRICAL ENGINEERING

IDENTIFIERS: (U) Free electron masers, Vircators.

(U) Competition Between Electromagnetic Modes in a Free-  
Electron Maser.

DESCRIPTIVE NOTE: Final technical rept. 1 Mar 90-28 Feb  
94,

FEB 94 90P

PERSONAL AUTHORS: McCurdy, Alan H.; Kasibhotla, V.; Liou,  
R.; Plewa, J. S.

CONTRACT NO. AFOSR-90-0155

PROJECT NO. 2305

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0305, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) A three part report is presented describing the mode competition in a gyrotron oscillator with two competing electromagnetic modes. Part I gives the theory of this mode coupling is presented using a quasi-linear assumption which is valid for small power levels. The results are interpreted in terms of the phase plane. These general results are applied to a specific case of mode competition, that between TE<sub>101</sub> and TE<sub>011</sub> modes in a cavity of rectangular cross section. Part II presents the theory of coupling which may occur between any number of cavity modes through finite conductivity in the cavity walls, holes in the conducting cavity walls, or through interaction with an electron beam. Part III details the experimental work. The electrodynamic circuit is described as are microwave and electron beam diagnostics. Results of initial tests are also given.

DESCRIPTORS: (U) \*ELECTRODYNAMICS, \*MASERS, \*MICROWAVE OSCILLATORS, \*GYROTRONS, \*ELECTROMAGNETIC SUSCEPTIBILITY, CAVITIES, CIRCUITS, CONDUCTIVITY, COUPLINGS, ELECTRON BEAMS, ELECTRONS, INTERACTIONS, MICROWAVES, OSCILLATORS, POWER LEVELS, TEST AND EVALUATION, FREE ELECTRONS, HIGH POWER, ELECTROMAGNETISM, PHASE MODULATION, ELECTRON GUNS.

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AD-A279 545 20/12 20/2 9/1 20/3

WESTINGHOUSE SCIENCE AND TECHNOLOGY CENTER PITTSBURGH PA

(U) High Temperature Superconducting Films and Multilayers for Electronics.

DESCRIPTIVE NOTE: Final rept. 21 Feb 91-20 Feb 94,

APR 94 209P

PERSONAL AUTHORS: Gavaler, John R.; Talvacchio, John

REPORT NO. WCTC-94-9SL2-SUPER-R1

CONTRACT NO. F49620-91-C-0034

PROJECT NO. 2305

TASK NO. GS

MONITOR: AFOSR, XC  
TR-94-0307, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The overall objective of this program was to develop a materials and fundamental device base for high-transition-temperature superconducting (HTS) electronics capable of operating at > 50K. Progress is reported on four tasks which address problems fundamental to the understanding of the superconducting state in HTS films, the application of HTS films in passive microwave circuits, the realization of HTS digital electronics, and the development of new superconducting devices. Large-area epitaxial YBCO films with low rf losses developed under this program and techniques for depositing them on both sides of single-crystal substrates were used in other Westinghouse and government-funded programs to develop HTS channelized filterbanks, delay lines, UHF antenna matching networks, and low-phase-noise resonators. An understanding was achieved of the role of oxygenation during film growth and the effect of film microstructure on rf losses. For HTS digital circuit fabrication, both active devices step-edge and edge-type YBCO Josephson junctions and trilayer BK80 junctions and passive structures were developed, such as crossovers.

DESCRIPTORS: (U) \*ELECTRONICS, \*FILMS, \*SUPERCONDUCTORS, \*HIGH TEMPERATURE, ANTENNAS, BARIUM, BARRIERS, CIRCUITS,

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COPPER, CRITICAL TEMPERATURE, DELAY LINES, EDGES, FABRICATION, JOSEPHSON JUNCTIONS, LOSSES, MATCHING, MATERIALS, MICROSTRUCTURE, MICROWAVES, NETWORKS, NOISE, OXIDES, PHASE, RESONATORS, SINGLE CRYSTALS, SPUTTERING, STRUCTURES, SUBSTRATES, TEMPERATURE, THIN FILMS, TUNNELING, YTTRIUM, LAYERS, TRANSITION TEMPERATURE, DIGITAL SYSTEMS, EPITAXIAL GROWTH, LOW NOISE, COMPOSITE MATERIALS, SEMICONDUCTOR DEVICES, QUANTUM THEORY, INTERFERENCE.

IDENTIFIERS: (U) PE61102F, WUAFOSR2305GS.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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SAN FRANCISCO STATE UNIV TIBURON CA ROMBERG TIBURON CENTERS

(U) Progress Report for Grant F49820-92-J-0232 (San Francisco State University).

DESCRIPTIVE NOTE: Annual rept. 1 Apr 93-31 Mar 94,

APR 94 74P

PERSONAL AUTHORS: Kun, Ernest

CONTRACT NO. F49820-92-J-0232

PROJECT NO. 2312

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0287, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Intracellular phosphorylation of poly (ADP-ribose) polymerase was assayed in streptolysin-O-permeabilized human lymphocytes. Whereas 32P incorporation from (gamma-32P)ATP into immunoprecipitated enzyme protein was undetectable in resting cells, significant phosphorylation of this enzyme was observed in lymphocytes treated with phytohemagglutinin. The phosphorylation of poly (ADP-ribose) polymerase in permeabilized cells was not stimulated by phorbol ester, but phosphorylation of other proteins and of a specific oligopeptide substrate of protein kinase C was increased by phorbol ester. The specific inhibitory pseudosubstrate peptide of protein kinase C blocked the phosphorylation of poly (ADP-ribose) polymerase induced by phytohemagglutinin. A potential role of a member of the protein kinase C family in the intracellular regulation of poly (ADP-ribose) polymerase by phosphorylation appears probable. The structure of poly (ADP-ribose) polymerase has been augmented by the identification of polypeptide sequences which define histone and self association. Both protein binding domains are components of 64-67 kDa basic moiety of poly ADP-ribose polymerase, obtained by degradation by chymotrypsin or plasmin. Two discrete histone binding domains are interspersed and contiguous with 'selfbinding domains and are located at

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188-290 and 446-525 residues. Self binding is confined to the 29 kDa N-terminal moiety of poly ADP-ribose polymerase and to two smaller polypeptide sequences 291-395 and 526-608 residues. Bound zinc is not required for self binding.

DESCRIPTORS: (U) \*ENZYMES, \*HISTONES, \*LYMPHOCYTES, \*PHOSPHORUS TRANSFERASES, BACTERIAL TOXINS, CELLS, CHYMOTRYPSIN, DEGRADATION, PHOSPHORYLATION, ESTERS, HUMANS, IDENTIFICATION, IN VITRO ANALYSIS, ORGANIZATIONS, PEPTIDES, PHOSPHORYLATION, DEOXYRIBONUCLEIC ACIDS, PLASMIN, PROTEINS, REGULATIONS, RESIDUES, RIBOSE, SEQUENCES, HYPOTHESES, STRUCTURES, SUBSTRATES, SYNTHESIS, TERMINALS, ZINC.

IDENTIFIERS: (U) WUAFOSR2312as, PE61102F, Polymerase, Phytohemagglutinin.



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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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CALIFORNIA UNIV SANTA BARBARA DEPT OF MATERIALS

(U) Growth and Electrical and Far-Infrared Properties of Wide Electron Wells in Semiconductors.

DENSITY, ELECTRODES, ELECTRON SCATTERING, ENERGY LEVELS, FREQUENCY, MEASUREMENT, MODIFICATION, MOTION, PRECISION, PURITY, RESONANT FREQUENCY, RESONATORS, STRUCTURES, MOLECULAR BEAMS, SOLID STATE ELECTRONICS, DOPING.

DESCRIPTIVE NOTE: Final technical rept. 15 Feb 91-14 Feb 94,

IDENTIFIERS: (U) \*Electron wells, Wide, Parabolic wells, Terahertz properties, High Q

APR 94 122P

PERSONAL AUTHORS: Gossard, Arthur C.

REPORT NO. UCSB-08-075892

CONTRACT NO. AFOSR-91-0214

PROJECT NO. 2305

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0285, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) The thrust of the research carried out under this grant has been the development and study of wide, specially shaped graded quantum wells for electrons in semiconductors, as synthesized by high-precision epitaxial growth. In basic characterization of the wide wells, fundamental measurements of charge density, energy levels, and electron motions in the wells were pursued. The achievement of high-Q solid state electron resonators at Terahertz frequencies in the wide wells was stressed. Highly resonant cavities with electron scattering times nearly two orders of magnitude larger than for electrons in high-purity uniformly doped wells of comparable electron concentration have been grown. Structures were also achieved in which the resonant frequency of the electrons could be changed by application of a potential to a control electrode. Modification of the parabolic potential by superposition of periodic potentials and the extension of the parabolic well concept to remotely doped hole wells were also emphasized.

DESCRIPTORS: (U) \*ELECTRONS, \*EPITAXIAL GROWTH, \*QUANTUM WELLS, \*SEMICONDUCTORS, \*ELECTRICAL PROPERTIES, \*FAR INFRARED RADIATION, CAVITIES, CAVITY RESONATORS, CHARGE

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SEARCH CONTROL NO. T4P42J

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NORTH CAROLINA STATE UNIV AT RALEIGH DEPT OF CHEMISTRY

MICHIGAN UNIV ANN ARBOR DEPT OF ELECTRICAL ENGINEERING  
AND COMPUTER SCIENCE(U) Chemistry and Electrochemistry in Lewis Acid and  
Supercritical Ionic Liquids.

(U) Massively-Parallel Computational Fluid Dynamics.

DESCRIPTIVE NOTE: Final rept. 1 Jul 92-31 Dec 93,

DESCRIPTIVE NOTE: Final technical rept. 15 Oct 89-14 Jan  
94,

APR 94 23P

MAR 94 7P

PERSONAL AUTHORS: Osteryoung, Robert A.

PERSONAL AUTHORS: Calahan, Donald

CONTRACT NO. F49620-92-J-0326

CONTRACT NO. AFOSR-90-0020

PROJECT NO. 2303

PROJECT NO. 2304

TASK NO. AS

TASK NO. A3

MONITOR: AFOSR, XC

MONITOR: AFOSR, XC

TR-94-0297, AFOSR

TR-94-0296, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) Studies in an ambient temperature chloroaluminate molten salt composed of aluminum chloride and 1-ethyl-3-methylimidazolium chloride were carried out. A variety of topics were investigated. Work on poly(p-phenylene) and silane based electroactive polymers was carried out. The electrochemistry of several Ru and Co complexes was examined, as was the kinetics of the ferroceneferrocenium couple as a function of melt viscosity. The electrochemistry of anthracene and 9,10-anthraquinone was examined under conditions where protonation of these species was important. Finally, proton speciation and proton equilibrium were examined by NMR and FT-IR spectroscopies. Chloroaluminates, ionic liquids, Electrochemistry, Nuclear magnetic resonance, Electroactive polymers.

DESCRIPTORS: (U) \*ELECTROCHEMISTRY, ALUMINUM, ANTHRACENES, ANTHRAQUINONES, CHLORIDES, FUNCTIONS, KINETICS, LIQUIDS, MAGNETIC RESONANCE, MELTS, MOLTEN SALTS, NUCLEAR MAGNETIC RESONANCE, POLYMERS, PROTONS, SILANES, TEMPERATURE, VISCOSITY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2303AS, Ionic liquids, Supercritical systems.

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ABSTRACT: (U) The effort has three major. (1) Gain algorithm experience in conversion of a suite of Air Force production (CFD codes to a general format applicable to a variety of such commercial architectures. (2) Examine the feasibility of using workstation networks for such distributed computation; this involves (a) developing timing models of the communication systems of such networks (b) projecting performance of the above codes on such networks, and (c) implementing one or more codes, as time permits. (3) Initiate research on (FD-based low-radar crosssection analysis on parallel systems: this effort is in association with Dr. Joseph Shang at WRDC.

DESCRIPTORS: (U) \*COMPUTATIONAL FLUID DYNAMICS, \*PARALLEL PROCESSING, ALGORITHMS, CONVERSION, FORMATS, PRODUCTION, RADAR, DISTRIBUTED DATA PROCESSING, COMPUTER NETWORKS, COMPUTER PROGRAMMING, MAXWELLS EQUATIONS, NAVIER STOKES EQUATIONS, SOLUTIONS(General), AIR FORCE RESEARCH.

IDENTIFIERS: (U) \*CEM(Computational Electromagnetics).

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AD-A279 387 6/3 5/8

ILLINOIS UNIV AT URBANA INST FOR ENVIRONMENTAL STUDIES

BOWMAN GRAY SCHOOL OF MEDICINE WINSTON-SALEM NC

(U) The Mechanisms and Effects Off the Plant-Activations of Chemicals in the Environment.

(U) Multiple Neuron Recording in the Hippocampus on Freely-Moving Animals.

DESCRIPTIVE NOTE: Annual rept. 30 Apr 92-29 Sep 93,

DESCRIPTIVE NOTE: Final rept. 1 Dec 89-30 Nov 93,

DEC 93 23P

MAR 94 6P

PERSONAL AUTHORS: Plewa, Michael J.

PERSONAL AUTHORS: Deadwyler, Sam A.

CONTRACT NO. AFOSR-91-0432

REPORT NO. BGSM-PP-94-001

PROJECT NO. 2312

CONTRACT NO. AFOSR-90-0092

TASK NO. AS

PROJECT NO. 3484

MONITOR: AFOSR, XC

TASK NO. HS

TR-94-0286, AFOSR

MONITOR: AFOSR, XC

TR-94-0294, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) Plants can activate promutagens into stable mutagens and these genotoxic agents may be hazardous to the environment and to the public health. Plant systems have been widely employed in classical and environmental mutagenesis. However, the environmental and human health impact of plants exposed to environmental xenobiotics were not well recognized until the presence of pesticide contaminants in food supplies caused alarm. The capability of plants to bioconcentrate environmental agents and activate promutagens into toxic metabolites is significant when one realizes the immense diversity of xenobiotics to which plants are intentionally and unintentionally exposed. Finally, we all must be attentive to the effects that toxic agents may have on the biosphere and the grave global consequences that would result in a disruption in the carbon cycle.

DESCRIPTORS: (U) \*ENVIRONMENTS, \*METABOLITES, \*PUBLIC HEALTH, CARBON, CONTAMINANTS, CYCLES, FOOD, GLOBAL, HEALTH, HUMANS, IMPACT, MUTAGENS, PESTICIDES, SUPPLIES, TOXIC AGENTS, WARNING SYSTEMS, PLANTS(BOTANY), ACTIVATION, AMINES, CELLS, AMINO ACIDS, DEOXYRIBONUCLEIC ACIDS, PHENYLENEDIAMINES, POTENCY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2313AS.

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ABSTRACT: (U) Progress over the four years of the project with regard to the development of multineuronal recording systems was significant. Since this was one of the main objectives of the consortium of three laboratories it was a principal focus of research efforts throughout the project. The development has resulted in a system capable of simultaneous experimental control and acquisition of behavioral events and electrophysiological data of up to 8 experimental chambers from a single minicomputer host. Development of the DSP-based action potential waveform analyzer ('spike-sorter') allows detection and identification of up to 128 single unit waveforms recorded from any combination of 128 microwire electrodes. The use of shaped microwire arrays allowed for precise placement of electrodes in distinct anatomic regions of the brain. Development of these systems occupied the entire first two years of the project, and much of the third year as well. Much of the research effort in the final two years was directed toward completion of several studies which were in preliminary stages at the time of submission are now near completion and have been published or prepared for publication. Specifically, these include the signal detection task and the DMTS task in which complex neurophysiological

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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analyses have revealed striking new relationships to sensory processing strategies in the hippocampus and cortex. The accompanying report summarized these and other accomplishments throughout the period of the award.

GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U) Diazasilene (SINN). A Comparison of Coupled Cluster Methods with Experiment and Local Density Functional Methods,

DESCRIPTORS: (U) \*HIPPOCAMPUS, \*NERVE CELLS, \*NEUROPHYSIOLOGY, ACQUISITION, ANALYZERS, ARRAYS, AWARDS, BRAIN, CHAMBERS, CONSORTIUMS, CONTROL, DETECTION, DOCUMENTS, ELECTRODES, IDENTIFICATION, LABORATORIES, MINICOMPUTERS, PROCESSING, RECORDING SYSTEMS, REGIONS, SIGNALS, SPIKES, STRATEGY, TIME, WAVEFORMS, SIGNAL PROCESSING, NEUROTRANSMITTERS.

92 4P

PERSONAL AUTHORS: Ignatyev, Igor; Schaefer, Henry, III

REPORT NO. F49620-92-J-0047

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0291, AFOSR

IDENTIFIERS: (U) WUAFOSR3484HS, PEB1103D.

UNCLASSIFIED REPORT

Availability: Pub. in The Jnl. of Physical Chemistry, v86 p7632-7634 1992. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Ab initio quantum mechanical methods have been applied to the 3 Sigma (-) electronic ground state of the diazasilene molecule SINN. Higher level electron correlation methods are found to significantly effect the predicted equilibrium geometry. The self-consistent-field (SCF) and single and double excitation configuration interaction (CISD) methods predict a loosely bound Si ... N(triple bonds)N structure. The single and double excitation coupled cluster method (CCSD) predicts both the loose structure and a tightly bound Si-N2 structure, with the latter lying 2.3 kcal/mol lower in energy. The highest level theoretical method, CCSD(T), includes all connected triple excitations and predicts only the tight Si-N2 structure. The CCSD(T) vibrational frequencies are in close agreement with experiment and in qualitative agreement with local density functional methods.

DESCRIPTORS: (U) \*SILICON, \*NITROGEN, CONFIGURATIONS, CORRELATION, DENSITY, ELECTRONICS, ELECTRONS, ENERGY, EXCITATION, FREQUENCY, GEOMETRY, GROUND STATE, INTERACTIONS, MOLECULES, STRUCTURES, REPRINTS, COMPARISON, QUANTUM THEORY, EQUILIBRIUM(GENERAL), VIBRATION, QUANTUM CHEMISTRY.

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WRIGHT STATE UNIV KETTERING OH DEPT OF BIOCHEMISTRY

IDENTIFIERS: (U) WUAFOSR2303FS, PE61102F, \*Diazastilene,  
\*SiNN, \*Coupled cluster methods, \*Local density  
functional method, CISD(Configuration Interaction Single  
Double), CCSD(Coupled Single Double), SCF(Self-Consistent-  
Field).

(U) Hepatic Metabolism of Perfluorinated Carboxylic Acids  
and Polychlorotrifluoroethylene: A Nuclear Magnetic  
Resonance Investigation in Vito.

DESCRIPTIVE NOTE: Annual rept. 1 Jun 92-31 May 93,

JAN 94 20P

PERSONAL AUTHORS: Reo, Nicholas V.

CONTRACT NO. F49620-92-J-0218

PROJECT NO. 3484

TASK NO. S4

MONITOR: AFOSR, XC  
TR-94-0295, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During the past year, this research program has focus in two main areas relating to the effects of PFOA and PFDA on hepatic metabolism, namely phospholipid and carbohydrate metabolism. Through the use of NMR spectroscopy and standard biochemical assays, these studies have probed specific metabolic pathways and examined the impact of perfluorocarboxylic acid exposure. This investigative strategy will delineate the metabolic effices exerted by these compounds and aid in developing a clearer understanding of the hepatotoxic mechanisms at play. In summary, these studies have demonstrated that PFDA treatment exhibits unique metabolic effects which are not observed with PFOA. PFDA depresses glucose transport into hepatocytes and inhibits glycogen synthesis. It also shows dramatic effects upon hepatic phospholipid metabolism. PFDA activates a phosphatidylcholine-specific phospholipase C which has important implications with regard to various cellular processes. It is likely that this effect of PFDA may trigger a cellular signaling mechanism through diacylglycerol and subsequent activation of protein kinase C. Current investigation in our laboratory are addressing these cellular metabolites, enzymes, and pathways. These research endeavors will provide new information regarding the mechanisms of toxicity associated with a class of

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compounds which are important in various Air Force applications.

GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

DESCRIPTORS: (U) \*ACIDS, \*CARBOHYDRATE METABOLISM, \*METABOLISM, \*TOXICITY, \*LIVER, ACTIVATION, ADDRESSING, AIR, AIR FORCE, ENZYMES, GLUCOSE, GLYCOGEN, IMPACT, LABORATORIES, METABOLITES, PHOSPHOLIPIDS, PHOSPHORUS TRANSFERASES, PROTEINS, RECREATION, SPECTROSCOPY, STANDARDS, STRATEGY, SYNTHESIS, TRANSPORT.

(U) Methylphosphinidene (CH3P) and its Rearrangement to Phosphaethylene (CH2PH): Toward the Observation of Ground-State Triplet CH3P,

93 7P

PERSONAL AUTHORS: Kim, Seung-Joon; Hamilton, Tracy P.; Schaefer, Henry F., III

IDENTIFIERS: (U) PEG1103D, WUAFOSR3484S4, \*Perfluorocarboxylic acid

CONTRACT NO. F49620-92-J-0047

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0300, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Physical Chemistry, v97 n9 p1872-1877, 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The CH3P radical, which may be produced in the pyrolysis of (CH3)3P, has not been observed experimentally. Starting from the potential energy surfaces for the CH3P-CH2PH rearrangement, we examine the properties of the lowest singlet (1A') and triplet (3A2) states of CH3P. The geometry optimizations are performed at the CISD level of theory with the TZ2P+ basis set. For the closed-shell singlet state of CH2=PH, the highest level and basis set is the CCSD level with the TZ2P basis. The lowest singlet state of CH3P is described starting from the two-configuration (TC) SCF method. As expected, the lowest excited singlet and triplet states of CH3P are subject to Jahn-Teller distortion and thus exhibit C sub symmetry. The singlet-triplet energy separations for CH3P and CH2PH are predicted to be -22.6 and 41.7 kcal/mol, respectively. The triplet-triplet excitation energy for CH3P is also predicted and compared with the experimental value for the parent molecule, PH. The theoretical geometry for the ground state (1A') of CH2PH agrees well with the experimental structure.

DESCRIPTORS: (U) \*GROUND STATE, \*PYROLYSIS, \*METHYL

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SEARCH CONTROL NO. T4P42J

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RADICALS, \*PHOSPHORS, CONFIGURATIONS, DISTORTION, ENERGY, EXCITATION, GEOMETRY, MOLECULES, OPTIMIZATION, POTENTIAL ENERGY, SEPARATION, STRUCTURES, SURFACES, SYMMETRY, REPRINTS, PHOSPHINE, QUANTUM CHEMISTRY, CHEMICAL RADICALS, ELECTRONIC STATES.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2303FS,  
\*Methylphosphinidene, \*Phosphaethylene, \*Triplet, Basis set, Configuration interaction, Coupled clusterm T22P, Self-consistent field, Singlet state.

AD-A279 350 7/4 7/2 20/5 20/10

GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U) The Fundamental Vibrational Frequencies of the silyl anion (SiH3-),

92 9P

PERSONAL AUTHORS: Shen, Mingzuo; Schaefer, Henry F., III

CONTRACT NO. F49620-92-J-0047, \$AFOSR-88-0167

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0290, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Molecular Physics, v76 n2 p467-474, 1992. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Ab initio quantum mechanical methods have been used to predict the vibrational frequencies for the silyl anion (SiH3-, C sub 3v). In the present study, the self-consistent field, the configuration interaction with single and double excitations, and the coupled cluster with single and double excitations wavefunctions were used in conjunction with the triple zeta plus double polarization plus diffuse function basis set. Anharmonicity has been explicitly considered using vibrational perturbation theory. The effects of diffuse s functions on the hydrogen atoms are found to be surprisingly large.

DESCRIPTORS: (U) \*ANIONS, \*FREQUENCY, \*HYDROGEN, \*VIBRATION, \*SILICON, ATOMS, CONFIGURATIONS, EXCITATION, INTERACTIONS, PERTURBATION THEORY, PERTURBATIONS, POLARIZATION, REPRINTS, QUANTUM THEORY, QUANTUM CHEMISTRY, WAVE FUNCTIONS.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2303FS, \*Silyl anion, Self-consistent field, Coupled cluster, Configuration interaction, Triple zeta, Basis set, Anharmonicity.

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GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U). Striking Similarities Between Elementary Silicon and Aluminum Compounds: Monobridged, Dibridged, Trans-Bent, and Vinylidene Isomers of Al<sub>2</sub>H<sub>2</sub>.

93 9P

PERSONAL AUTHORS: Palagyi, Zoltan; Grev, Roger S.; Schaefer, Henry F., III

CONTRACT NO. F49620-92-J-0047

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0302, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of the American Chemical Society, V115 n5 p1936-1943, 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Ab initio quantum mechanical methods have been used to study the singlet potential energy surface of Al<sub>2</sub>H<sub>2</sub>. Optimum geometries and harmonic vibrational frequencies were obtained for four geometrical isomers using the self-consistent-field (SCF), configuration interaction (CI), and coupled cluster (CC) methods. Both correlation methods including single and double excitations (CISD, CCSD) were employed, and all wave functions were determined with both DZP and TZ2P basis sets. Final energy predictions are obtained using the atomic natural orbital basis sets, and including the effects of triple excitations perturbatively using CCSD(T) methods. We found the planar dibridged structure to be the global minimum, as predicted earlier by Baird. However, our analysis also predicts the existence of a remarkable monobridged minimum, which has recently been observed experimentally for Si<sub>2</sub>H<sub>2</sub>. Two additional low-lying minima are found, corresponding to trans-bent and vinylidene-like structures. The dibridged, monobridged, and trans-bent structures can be understood as resulting from the three possible ways of coordinating the two electron-rich sites of diatomic AlH to the electron-

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deficient aluminum centers. The energy of these structures with respect to dissociation to two AlH monomers is quite low and is related to the large difference between the first and second Al-H bond dissociation energies of the parent AlH<sub>3</sub> compound.

DESCRIPTORS: (U) \*ALUMINUM, \*CORRELATION, \*ISOMERS, \*SILICON, \*QUANTUM CHEMISTRY, \*ATOMIC ORBITALS, \*DIATOMIC MOLECULES, CONFIGURATIONS, DISSOCIATION, ELECTRONS, ENERGY, EXCITATION, FREQUENCY, FUNCTIONS, GLOBAL, HARMONICS, INTERACTIONS, MONOMERS, POTENTIAL ENERGY, PREDICTIONS, SITES, STRUCTURES, SURFACES, WAVE FUNCTION, QUANTUM THEORY, ELECTRONIC STATES, GEOMETRY, VIBRATION, REPRINTS.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2303FS, \*Vinylidene, Monobridged, Dibridged, Trans-bent, Self-consistent field, Coupled clusters, Configuration interaction, Single, Double, Basis sets, TZ2P



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## DTIC REPORT BIBLIOGRAPHY

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CALIFORNIA UNIV IRVINE

HARVARD COLL OBSERVATORY CAMBRIDGE MA

(U) Time Resolved X-Ray Detection.

(U) Absolute, Extreme-Ultraviolet Solar Spectral Irradiance Monitor (AESSIM).

DESCRIPTIVE NOTE: Final rept. 1 Jul 89-31 Dec 93,

DESCRIPTIVE NOTE: Final technical rept. 15 Nov 89-14 Nov 93,

APR 94 45P

PERSONAL AUTHORS: Rentzepis, Peter M.

APR 94 24P

CONTRACT NO. F49620-89-C-0104

PERSONAL AUTHORS: Parkinson, W. H.; Smith, Peter L.

PROJECT NO. 6835

CONTRACT NO. AFOSR-90-0063

TASK NO. 00

PROJECT NO. 2310

MONITOR: AFOSR, XC  
TR-94-0303, AFOSR

TASK NO. A2

MONITOR: AFOSR, XC  
TR-94-0293, AFOSR

## UNCLASSIFIED REPORT

**ABSTRACT:** (U) The goal of the project was to design, develop and construct an x-ray detector with high sensitivity and picosecond time resolution. This was achieved. A Ford Aerospace Charged Coupled Device, CCD, was utilized as the x-ray sensitive material around which the design and construction of the picosecond x-ray detector was built. This device has now become a commercial product sold, among other companies, by Photometrics Inc., and Princeton Research Inc. In addition we designed and built the first picosecond x-ray system. This system was utilized for the first ever picosecond x-ray diffraction experiments. The picosecond x-ray system was utilized in the oxidative fuel cell project to measure the decomposition of methanol and the change of the structure of its platinum catalyst. Another direct product of the work is the publication of 38 papers, in major scientific journals, and two patents.

**DESCRIPTORS:** (U) \*DETECTORS, \*X RAYS, CATALYSTS, CELLS, CHARGE COUPLED DEVICES, CONSTRUCTION, DECOMPOSITION, DOCUMENTS, FUEL CELLS, FUELS, HIGH SENSITIVITY, MATERIALS, METHANOLS, PATENTS, PLATINUM, RESOLUTION, SENSITIVITY, STRUCTURES, TIME, WORK, X RAY DIFFRACTION.

IDENTIFIERS: (U) PE61101F, WUAFOSR683500.

## UNCLASSIFIED REPORT

**ABSTRACT:** (U) The goal of this research program was development of a method for obtaining daily radiometrically accurate, solar spectral irradiance data at EUV wavelengths. In orbit radiometric instrumentation recalibration is a fundamental requirement for accurate spectral flux measurements. We have studied a low-pressure version of the EUV radiance standard and concluded that a substantial redesign of it would be required if a suitable one is to be developed, for in orbit calibration of a solar spectral irradiance monitor. We have reviewed the use, suitability, and the availability of thin film filters for in orbit EUV calibration. In our opinion, the availability of space qualified filters has not been verified. We have evaluated and chosen a design of a 4-spectrograph, flat-field package that provides 0.1 to 0.2 nm resolution in the range 9-175 nm with a total weight including detectors of 1.6 Kg. Several mission concepts, which involve rocket-borne, calibrated spectrometer underflights to recalibrate the Voyager spacecraft have been considered. Solar, Extreme-ultraviolet, Radiometric calibration.

**DESCRIPTORS:** (U) \*CALIBRATION, \*ULTRAVIOLET, SPECTROMETERS, \*SOLAR RADIATION, AVAILABILITY, RADIOMETRY,

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LOW PRESSURE, MONITORS, INTERPLANETARY SPACE, EARTH ORBITS, ULTRAVIOLET FILTERS, RADIANCE, RESOLUTION, ROCKETS, RADIANT FLUX DENSITY, EXPERIMENTAL DESIGN, SPACECRAFT, THIN FILMS, MODEL TESTS.

GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U) P03--(H2O)n Clusters. Molecular Anion Structures, Energetics, and Vibrational Frequencies,

IDENTIFIERS: (U) PEG1102F, WUAFOSR2310A2, Extreme ultraviolet, AESSIM(Absolute Extreme Ultraviolet Solar Spectral Irradiance Monitor), Voyager spacecraft.

93 10P

PERSONAL AUTHORS: Ma, Buyong; Xie, Yaoming; Shen, Mingzuo; Schaefer, Henry, III

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0298, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of the American Chemical Society, n115 p1943-1951 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The P03-(H2O)n clusters (n = 1, 2, and 3) have been studied using ab initio quantum mechanical methods. Self-consistent field (SCF), configuration interaction with single and double excitations (CISD), and coupled cluster single and double excitation (CCSD) levels of theory were employed in conjunction with basis sets of quality double-zeta (DZ), double-zeta plus polarization (DZP), and DZP plus diffuse functions. The most important finding is that the clusters prefer to form high-symmetry double acceptor hydrogen bonds between the P03 anion and the H2O molecules. The hydrogen bond lengths increase and the dissociation energies decrease with the addition of successive water molecules

DESCRIPTORS: (U) \*PHOSPHATES, \*ANIONS, \*MOLECULAR STRUCTURE, \*ENERGETIC PROPERTIES, \*VIBRATION, \*FREQUENCY, \*EXCITATION, REPRINTS, QUANTUM THEORY, WATER, POLARIZATION, SYMMETRY, HYDROGEN BONDS, ELECTRON ACCEPTORS, ELECTRON DONORS, DISSOCIATION, ENERGY, MOLECULES.

IDENTIFIERS: (U) WUAFOSR2303FS, PEG1102F, \*Clusters, SCF(Self-Consistent Field), CISD(Configuration Interaction Single Double), CCSD(Coupled Cluster Single Double), DDouble-Zeta)

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GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U) The Tetramer of Borane and Its Heavier Valence-Isoelectronic Analogs: M4H12 with M=B, Al, and Ga,

93 22P

PERSONAL AUTHORS: Shen, Mingzuo; Liang, Congxin; Schaefer, Henry F., III

CONTRACT NO. F49620-92-J-0047

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0301, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in Chemical Physics, v171 p325-345, 1993. Available only to DTIC users. No copies furnished by NTIS.

**ABSTRACT:** (U) Ab initio all-electron quantum mechanical methods were applied to the tetramers of borane (BH<sub>3</sub>) and its analogs in the periodic table, namely the molecules B<sub>4</sub>H<sub>12</sub> (tetraaborane (12) or (BH<sub>3</sub>)<sub>4</sub>), (tetraalane (12) or (AlH<sub>3</sub>)<sub>4</sub>), Ga<sub>4</sub>H<sub>12</sub> (tetragallane (12) or (GaH<sub>3</sub>)<sub>4</sub>). Four closed-shell stationary points were found for each tetramer. In addition, the butterfly tetraaborane (10) (B<sub>4</sub>H<sub>10</sub>) and its analogs tetraalane (10) (Al<sub>4</sub>H<sub>10</sub>) and tetragallane (10) (Ga<sub>4</sub>H<sub>10</sub>) were investigated at comparable levels of theory. Geometry optimizations were performed at correlated levels whenever practical, and at the Hartree-Fock level otherwise, using sizeable basis sets. In most cases, energetic information was obtained from correlated methods. It is confirmed that the most recent (1981) experimental structures for tetraaborane (10) have an error for one of the bridging B-H bond distances, as noted recently by Buhl and Schleyer. However, the other three experimental structures for B<sub>4</sub>H<sub>10</sub> also have serious problems. Our results suggest that the molecular structures of butterfly M<sub>4</sub>H<sub>10</sub>, M=B, Al, Ga, are very similar. The structures of M<sub>4</sub>H<sub>12</sub>, M=B, Al, Ga, although still quite similar, show more variations. We found that the butterfly (12) structures, belonging to the point

group C sub 2v are local minima at the SCF potential energy surfaces. The butterfly tetraaborane (12) is energetically less stable than the butterfly tetraaborane (10) plus molecular hydrogen

**DESCRIPTORS:** (U) \*BORANES, \*HYDRIDES, \*VALENCE-ELECTRONS, REPRINTS, BORON HYDRIDES, GALLIUM, HARTREE FOCK APPROXIMATION, QUANTUM CHEMISTRY, CHEMICAL BONDS, MOLECULAR STRUCTURE, POLYMERS.

**IDENTIFIERS:** (U) WUAFOSR2303FS, PE61102F, \*Tetramers, Chemical physics, Tetraaborane, Tetraalane, Tetragallane, Basis sets, Bridging, Butterfly, \*Isoelectronic

## UNCLASSIFIED

## DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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AD-A279 311 7/4 7/2 20/10

## GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

## GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U) The Dodecahedral N<sub>20</sub> Molecule. Some Theoretical Predictions,(U) Ga<sub>2</sub>H<sub>2</sub>: Planar Dibridged, Vinylidene-like, Monobridged, and Trans equilibrium Geometries,

OCT 92 5P

FEB 93 7P

PERSONAL AUTHORS: Blizmyuk, Andrey; Shen, Mingzuo; Schaefer, Henry, III

PERSONAL AUTHORS: Palagyi, Zoltan; Schaefer, Henry F., III; Kapuy, Ede

CONTRACT NO. F49620-92-J-0047

CONTRACT NO. F49620-92-J-0047

PROJECT NO. 2303

PROJECT NO. 2303

TASK NO. FS

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0292, AFOSRMONITOR: AFOSR, XC  
TR-94-0299, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

Availability: Pub. in Chemical Physics Letters, v198 n3, 4 p249-252, 9 Oct 92. Available only to DTIC users. No copies furnished by NTIS.

Availability: Pub. in Chemical Physics Letters, v203 n2, 3 p195-200, 19 Feb 93. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Ab initio quantum mechanical methods have been applied to the I sub h point group isomer of N(20). Dodecahedral N(20) is predicted to be a relative minimum on its potential energy hypersurface, lying above separated nitrogen molecules by about 50 kcal per mol of nitrogen atoms. Vibrational frequencies, infrared intensities, and ionization potentials are also predicted.

DESCRIPTORS: (U) \*NITROGEN, \*OXIDES, ATOMS, FREQUENCY, INTENSITY, IONIZATION POTENTIALS, ISOMERS, MOLECULES, POTENTIAL ENERGY, REPRINTS, PREDICTIONS, QUANTUM CHEMISTRY, VIBRATION, INFRARED SPECTRA, ORGANIC COMPOUNDS, SYMMETRY, CHEMICAL BONDS, MINDO MOLECULAR ORBITALS.

IDENTIFIERS: (U) WUAFOSR2303FS, PE81102F, \*Dodecahedral, Hypersurfaces, Chemical physics, Cluster species.

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DESCRIPTORS: (U) \*GALLIUM, \*HYDRIDES,

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\*EQUILIBRIUM(GENERAL), \*HYDROGEN, ATOMS, CONFIGURATIONS, ENERGY, EXCITATION, FREQUENCY, REPRINTS, FUNCTIONS, GLOBAL, HARMONICS, INTERACTIONS, ISOMERS, POLARIZATION, POTENTIAL ENERGY, PREDICTIONS, STRUCTURES, SURFACES, VALENCE, CHEMICAL BONDS, ELECTRONS, GEOMETRY, VIBRATION, QUANTUM CHEMISTRY.

GEORGIA UNIV RESEARCH FOUNDATION INC ATHENS

(U) Sulfur Clusters: Structure, Infrared, and Raman Spectra of Cyclo-S<sub>6</sub> and Comparison with the Hypothetical Cyclo-O<sub>6</sub> Molecule,

92 11P

IDENTIFIERS: (U) WUAFOSR2303FS, PE81102F, \*Planar, \*Dibridged, \*Monobridged, \*Trans, Singlet, Chemical physics, Basis set, \*Vinylidene.

PERSONAL AUTHORS: Xie, Yaoming; Schaefer, Henry F., III; Jang, Jee H.; Mhin, Byung J.; Kim, Ho Soon

CONTRACT NO. F49620-92-J-0047

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0289, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Molecular Physics, v76 n3 p537-546 1992. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Ab initio quantum mechanical methods have been applied to the S<sub>6</sub> and O<sub>6</sub> molecules at their respective D(3d) hexagonal chair equilibrium geometries. Double zeta plus polarization (DZ + P) and triple zeta plus double polarization (TZ + 2P) basis sets have been used in conjunction with the self-consistent field (SCF) method and second-order perturbation theory. Equilibrium geometries, harmonic vibrational frequencies, infrared intensities, and Raman intensities have been predicted for the two cyclic molecules. Two previous vibrational, difficulties between theory and experiment for S<sub>6</sub> have been resolved. The O<sub>6</sub> molecule appears to be similar to the well-characterized S<sub>6</sub> in several respects. However, its dissociation energy and vibrational frequencies reveal a much flatter potential energy surface for O<sub>6</sub> in the region of the equilibrium geometry. While still predicted to correspond to a genuine potential minimum, O<sub>6</sub> nevertheless lies about 100 kcal/mol above three separated O<sub>2</sub> molecules. From a methodological viewpoint, the single configuration Hartree-Fock approach is found to be qualitatively satisfactory for S<sub>6</sub>, but very poor for O<sub>6</sub>.

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AD-A279 203 20/2 7/4 7/2 9/1

ILLINOIS UNIV AT CHICAGO CIRCLE DEPT OF PHYSICS

DESCRIPTORS: (U) \*SULFUR, \*MOLECULAR STRUCTURE, \*RAMAN SPECTRA, \*INFRARED SPECTRA, CHAIRS, CONFIGURATIONS, DISSOCIATION, ENERGY, REPRINTS, FREQUENCY, GEOMETRY, HARMONICS, INTENSITY, MOLECULES, PERTURBATION THEORY, PERTURBATIONS, POLARIZATION, POTENTIAL ENERGY, QUANTUM CHEMISTRY, REGIONS, SURFACES, EQUILIBRIUM(GENERAL), VIBRATION, FREQUENCY, HARTREE FOCK APPROXIMATION.

(U) MBE Growth, Characterization and Electronic Device Processing of Hg-Based Semiconductor Alloys and Heterostructures.

DESCRIPTIVE NOTE: Final rept.,

DEC 93 52P

PERSONAL AUTHORS: Faurie, Jean-Pierre

CONTRACT NO. F49620-90-C-0090

MONITOR: AFOSR, XC  
TR-94-0282, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The main objective of this contract was to improve the crystal quality of CdTe(111)B grown directly on silicon (100) substrate. At the starting date of this contract (Sept 1990) the best CdTe(111)B grown on Si(100) had double crystal x-ray rocking curves (DCRC) FWHM of 460 arcsec. These layers were exhibiting double domains and were plagued by microtwins. At the end of this contract we are routinely growing single-domain twin-free CdTe(111)B epilayers on Si(100). The best DCRC.FWHM are of 100 arcsec which is equivalent of better than that of CdTe grown on Si with a buffer layer such as GaAs or (Ca,Ba)F<sub>2</sub>. The drastic improvement is due to a systematic investigation of the Si substrate tilt, an understanding of the driving forces for double-domain and microtwin suppression along with a precise control of the growth parameters.

DESCRIPTORS: (U) \*MOLECULAR BEAMS, \*EPITAXIAL GROWTH, \*ELECTRONIC EQUIPMENT, \*MERCURY, \*SEMICONDUCTOR DEVICES, \*ALLOYS, BUFFERS, CRYSTALS, GALLIUM ARSENIDES, LAYERS, PARAMETERS, SILICON, SUBSTRATES, SUPPRESSION, TILT, X RAYS, CADMIUM, TELLURIDES.

IDENTIFIERS: (U) \*Heterostructures, DCRC(Double Crystal Xray Rocking Curves), Epilayers, Microtwin, MBE.

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EPIR LTD OAKBROOK IL

STANFORD UNIV CA DEPT OF APPLIED PHYSICS

(U) Industrial Exploitation of a Alternate Technology for the Production of HgCdTe Epilayers, Structures and Devices.

(U) High Temperature Superconducting Films and Crystals.

DESCRIPTIVE NOTE: Final rept. 15 Jan 91-14 Nov 93,

DESCRIPTIVE NOTE: Final rept.,

NOV 93 7P

FEB 94 72P

PERSONAL AUTHORS: Kapitulnik, A.; Geballe, T. H.

PERSONAL AUTHORS: Faurie, Jean-Pierre

CONTRACT NO. AFOSR-91-0145

CONTRACT NO. F49620-91-C-0007

PROJECT NO. 2305

MONITOR: AFOSR, XC  
TR-94-0281, AFOSR

TASK NO. GS

MONITOR: AFOSR, XC  
TR-94-0283, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

ABSTRACT: (U) The program goals was: Estimate the total cost to produce an MBE-grown HgCdTe epitaxial wafer suitable for the industrial manufacture of an IR photo diode detector array. Establish manufacturing procedure for MBE-grown HgCdTe epitaxial layers in order to bring to the market a product which is suitable for FPAs. Growth of high quality HgCdTe single epilayers and heterostructures with extremely uniform physical properties. The following characteristics, according to the program goals, were expected to be reached at the end of this program.

ABSTRACT: (U) The work carried out under this grant has been the investigation of thin films and single crystals of the layered cuprate high-temperature superconductors, as well as other model systems. A primary objective in the program was the development of a better understanding of the limits of the occurrence of superconductors with high transition temperature (above liquid nitrogen temperature). The work is thus composed of an empirical part that searches for superconductivity by similarities and chemical guidance as well as critical tests for various theories of the high-Tc mechanism. Another aspect of the program was to study the superconducting and normal state properties in applied magnetic fields, in particular we studied the coupling between the Cu-O layers in superlattices. We employed the artificially layered Superconductor/insulator system of MoGe/Ge which have in-plane and out-of plane anisotropies which bracket those found in the layered cuprates model system.

DESCRIPTORS: (U) \*MERCURY CADMIUM TELLURIDES, \*STRUCTURES, ARRAYS, COSTS, DETECTORS, DIODES, ESTIMATES, LAYERS, MANUFACTURING, PHYSICAL PROPERTIES, WAFERS, MOLECULAR BEAMS, EPITAXIAL GROWTH, INFRARED EQUIPMENT, PHOTODIODES, SUBSTRATES, COMPOSITE MATERIALS, ELECTRICAL PROPERTIES.

IDENTIFIERS: (U) \*Industrial exploitation, \*Epilayers, Devices

DESCRIPTORS: (U) \*CRYSTALS, \*FILMS, \*HIGH TEMPERATURE SUPERCONDUCTORS, \*SUPERCONDUCTORS, CHEMICALS, COUPLINGS, GUIDANCE, HIGH TEMPERATURE, LAYERS, COPPER, OXIDES, MOLYBDENUM, LIQUID NITROGEN, LIQUIDS, MAGNETIC FIELDS, MODELS, NITROGEN, GERMANIUM, SINGLE CRYSTALS, SUPERCONDUCTIVITY, SUPERLATTICES, TEMPERATURE, TEST AND EVALUATION, THIN FILMS, TRANSITION TEMPERATURE, TRANSITIONS.

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DUKE UNIV DURHAM NC

IDENTIFIERS: (U) WUAFOSR2305GS, Cuprates.

(U) A URI Program for Ultraviolet/Extreme Ultraviolet Research.

DESCRIPTIVE NOTE: Final rept. 1 Feb 90-31 May 93,

APR 94 55P

PERSONAL AUTHORS: Madey, John M.

CONTRACT NO. AFOSR-90-0112

PROJECT NO. 3484

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0284, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The purpose of the 3-year effort was to facilitate research and training in free electron laser and synchrotron device physics in the UV/XUV portion of the spectrum and to undertake research in those areas of optical technology, materials science, chemistry and physics relevant to the requirements, and capabilities of these devices. As documented here, these objectives were accomplished by: (1) Developing the basic instrumentation and operating support required to carry out the research and training objectives of the program; (2) Providing direct support for research on selected topics to be carried out using these facilities; (3) Encouraging graduate and undergraduate education in the scientific disciplines which form the basis of these technologies; and (4) Promoting enhanced contacts with the scientific staff of the DoD laboratories. The successful completion of this effort has provided the FEL Laboratory, its faculty, students and collaborators with the unique resources required for the continuing pursuit of research in these fields.

DESCRIPTORS: (U) \*FREE ELECTRON LASERS, \*STORAGE RINGS, \*SYNCHROTRONS, \*ELECTRON ACCELERATORS, \*ULTRAVIOLET SPECTRA, LIGHT PULSES, ELECTRON BEAMS, ULTRAVIOLET LASERS, SYNCHROTRON RADIATION, ELECTROMAGNETIC WAVE PROPAGATION, X RAYS, MULTISPECTRAL, INFRARED OPTICAL SYSTEMS, NUCLEAR

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INSTRUMENTATION, TEST FACILITIES, BRIGHTNESS, MAGNETS,  
COMPTON SCATTERING, BEAM SPLITTING, PHASE LOCKED SYSTEMS.

IDENTIFIERS: (U) WUAFOSR3484ES, Linac.

AD-A279 142 18/2 7/4 7/3 20/3

COLUMBIA UNIV NEW YORK LOWELL MEMORIAL LIBRARY

(U) Examination of Exchange Interaction Through Micelle  
Size: 2. Isotope Separation Efficiency as an  
Experimental Probe.

DESCRIPTIVE NOTE: Scientific rept.,

94 13P

PERSONAL AUTHORS: Tarasov, Valery F.; Ghatlia, Naresh D.;  
Avdievich, Nikolai I.; Shkrob, Iliya A.; Buchachenko,  
Anatolii L.

CONTRACT NO. AFOSR-91-0340

PROJECT NO. 2303

TASK NO. B2

MONITOR: AFOSR, XC  
TR-94-0279, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in the Jnl. of the American Chemical  
Society, v118 n6 p2281-2291 1994. Available only to DTIC  
users. No copies furnished by NTIS.

ABSTRACT: (U) The geminate reaction probabilities (for  
recombination and disproportionation) of benzoyl/sec-  
phenethyl-radical pairs, generated by the photolysis of  
alpha-methyldeoxybenzoin, for both unlabeled ( $^{13}\text{C}$  in  
natural abundance at the carbonyl position) and labeled  
ketones ( $^{13}\text{C}$  in the carbonyl position) were measured in  
different sized alkyl sulfate micelles (sodium octyl  
sulfate (C8) through sodium dodecyl sulfate (C12) in zero  
and high magnetic fields ( $B = 2400\text{ G}$ ). Although the  
probability of geminate recombination (pr) diminishes for  
the unlabeled pair, for 0.549 to 0.436 and for the  
labeled pair from 0.585 to 0.504 at zero magnetic field  
with decreasing micelle size (C12 to C8), the efficiency  
of isotope separation (alpha) is found to increase at  
zero magnetic field from 1.144 to 1.236 with decreasing  
micelle size. Theoretical considerations of these  
experimental results show that the rate of geminate  
reaction of the unlabeled radical pairs in small micelles  
is sensitive to the electron spin exchange interaction;

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intersystem crossing is influenced by fast forced reencounters. These effects are not as important for the labeled radical pairs (which possess a strong 13C hyperfine interaction). Micelles, Magnetic isotope separation, Radical pairs.

DESCRIPTORS: (U) \*EFFICIENCY, \*EXCHANGE, \*INTERACTIONS, \*ISOTOPE SEPARATION, CROSSINGS, DISPROPORTIONATION, ELECTRONS, CARBONYL COMPOUNDS, KETONES, ALKYL RADICALS, ELECTRON SPIN RESONANCE, MAGNETIC FIELDS, PHOTOLYSIS, PROBABILITY, RATES, REDUCTION, REPRINTS, SODIUM, SULFATES, PROBES, CHEMICAL REACTIONS, LABELED SUBSTANCES.

IDENTIFIERS: (U) PE81102F, WUAFOSR230382, \*Micelle size, Geminate, Benzoyl, Phenethyl, Methyldeoxybenzoin, Octyl, Dodecyl, \*Radical pairs, Hyperfine interaction.

AD-A279 140 7/2 7/4 20/6 7/5

CORNELL UNIV ITHACA NY DEPT OF CHEMISTRY

(U) Anisotropy and Energy Disposal in the 193-nm N20 Photodissociation Measured by VUV Laser-Induced Fluorescence of ((1)D).

93 5P

PERSONAL AUTHORS: Springsteen, L. L.; Satyapal, S.; Matsumi, Y.; Dobeck, L. M.; Houston, Paul L.

CONTRACT NO. F49620-92-J-0080

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0265, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Physical Chemistry, v97 n28 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Laser-induced fluorescence near 115 nm has been used to measure the Doppler profile of the ((1)D) product of 193-nm N20 photolysis. The anisotropy of product recoil vectors is characterized by the parameter Beta = 0.50 +/- 0.05. The measured velocity distribution can be used to calculate a distribution of recoil energies that is in reasonable agreement with that reported recently by Felder, Haas, and Huber; an average of 27.3 kcal/mole is deposited into translation, leaving approx. 37 kcal/mole for the internal excitation of the N2 fragment. Vacuum ultraviolet light, Molecular dynamics, Nitrous oxide.

DESCRIPTORS: (U) \*ANISOTROPY, \*LASER INDUCED FLUORESCENCE, \*NITROUS OXIDE, \*RECOIL, \*ENERGY, \*DISPOSAL, \*PHOTODISSOCIATION, DISTRIBUTION, DYNAMICS, EXCITATION, FLUORESCENCE, FRAGMENTS, INTERNAL, LIGHT, PARAMETERS, PHOTOLYSIS, PROFILES, VACUUM, VELOCITY, REPRINTS, ELECTRONIC STATES, GROUND STATE.

IDENTIFIERS: (U) PE81102F, WUAFOSR230382, VUV(Vacuum Ultraviolet) Light, Molecular dynamics

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 ALABAMA A AND M UNIV NORMAL DEPT OF PHYSICS  
 (U) Infrared to Visible Energy Upconversion in Er(3+) -  
 Doped Oxide Glass,

MAR 94 4P

PERSONAL AUTHORS: Reddy, B. R.; Venkateswarlu, P.

CONTRACT NO. AFOSR-90-0160

PROJECT NO. 3484

TASK NO. RS

MONITOR: AFOSR, XC  
 Tr-94-0273, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in Applied Physics Letters, v64 n11  
 p1327-1329, 14 Mar 94. Available only to DTIC users. No  
 copies furnished by NTIS.

ABSTRACT: (U) Intense Green Emission was observed at  
 room temperature from 4S 3/2 level Er 3+ doped in a  
 multielement oxide glass when the 4I 9/2 level was  
 resonantly excited with a near-infrared laser beam of 797  
 nm. Our studies indicate that energy transfer an excited  
 state absorption are responsible for the generation of  
 upconverted green emission from the sample. The  
 upconversion efficiency is found to be 0.14%. Energy  
 upconversion, Upconversion lasers.

DESCRIPTORS: (U) \*ENERGY TRANSFER, \*GLASS, \*INFRARED  
 LASERS, \*OXIDES, \*INFRARED SPECTRA, \*VISIBLE SPECTRA,  
 \*ERBIUM, \*CATIONS, ABSORPTION, EFFICIENCY, EMISSION,  
 LASER BEAMS, LASERS, ROOM TEMPERATURE, TEMPERATURE,  
 TRANSFER, REPRINTS, BORON, BARIUM, DOPING, YTTRIUM,  
 GREEN(COLOR), TUNGSTEN, EXCITATION, IONS, LANTHANUM,  
 CONVERSION, LEAD(METAL), TELLURIUM, MAGNESIUM, TITANIUM,  
 SILICON, RARE EARTH ELEMENTS.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484RS, Upconversion.

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ILLINOIS UNIV AT URBANA DEPT OF CIVIL ENGINEERING

(U) Cement Paste Matrix Composite Materials Center.

DESCRIPTIVE NOTE: Final rept. Apr 92-Sep 93,

NOV 93 26P

PERSONAL AUTHORS: Young, J. F.

CONTRACT NO. AFOSR-90-0242

PROJECT NO. 3484

TASK NO. A8

MONITOR: AFOSR, XC  
 TR-94-0270, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) Investigations of the development of the  
 microstructure of MDF (Macro-defect-free) cement during  
 processing, showed progressive changes in the properties  
 of the poly(vinyl alcohol) matrix. Excessive processing  
 times lead to the introduction of macro-defects, caused  
 by failure of either interphase or polymer matrix. Macro-  
 defects are proceeded by the formation of small tears or  
 voids which coalesce and enlarge. Further studies on the  
 interdiffusion of polymer interfaces has provided the  
 first experimental evidence of the polymer reptation  
 theory. Interfaces develop fractal character and will  
 influence the fracture of polymer welds and confined  
 polymer fluids. NMR spectroscopy studies on hydration of  
 cementitious compounds have been extended to calcium  
 silicates, using 17O for the first time. Calcium x-ray  
 adsorption spectroscopy has also been used in an  
 exploratory study. The formation of an reaction  
 intermediate with five coordinated silicon was observed.  
 The conditions of synthesis of intercalated PVA  
 'organoceramic' complex have been explored. The results  
 suggest that this complex cannot form in MDF cements. An  
 organotitanium complex that improves the water resistance  
 of MDF cement has been shown to form a 3-dimensional PVA  
 gel which is dehydrated to form a water impervious film.  
 The role of PVA cross-linking in controlling processing  
 and properties is discussed.

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AD-A279 012 20/11 20/6

DESCRIPTORS: (U) \*CEMENTS, \*POLYMERS, \*VINYL ALCOHOL, \*PASTES, \*COMPOSITE MATERIALS, \*MATRIX MATERIALS, ADSORPTION, CALCIUM, FAILURE, FILMS, FLUIDS, FRACTALS, GELS, HYDRATION, INTERFACES, MICROSTRUCTURE, PROCESSING, RESISTANCE, SILICATES, SILICON, SPECTROSCOPY, SYNTHESIS, VOIDS, WATER, WELDS, X RAYS, DIFFUSION, FRACTURE(MECHANICS), NUCLEAR MAGNETIC RESONANCE, CERAMIC MATERIALS, ORGANIC MATERIALS, TITANIUM, CROSSLINKING(CHEMISTRY).

RHODE ISLAND UNIV KINGSTON DEPT OF MECHANICAL ENGINEERING AND APPLIED MECHANICS

(U) Studies of the Effect of Microstructure on the Dynamic Behavior of Granular and Particulate Media. (First Year Report).

DESCRIPTIVE NOTE: Annual rept. Mar 93-Feb 94,

MAR 94 157P

IDENTIFIERS: (U) PEG1103F, WUAFOSR3484A8, Poly(Vinyl Alcohol), Macro-defects, Tears, Organoceramic, Reptation.

PERSONAL AUTHORS: Shukla, Arun; Sadd, Martin H.

CONTRACT NO. F40620-91-1-0209

PROJECT NO. 2302

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0267, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) A combined experimental-numerical investigation is being conducted to study dynamic load transfer in particulate materials due to explosive loadings. The primary emphasis in the study is to relate the microstructural features of the particulate media to the load transfer process. The experimental techniques of dynamic photoelasticity is used to investigate the effect of cementation and of the particle shape on the local contact stress fields. The stiffness of the cement relative to that of the particle controls the location of the peak contact stresses. Strong cementation increases the load transfer velocity and also promotes fracture of the particles. The particle shapes as presently studied in this research program seem to have little influence on the load transfer process. The applicability of the fiber optic sensors and the speckle techniques to contact stress measurements is evaluated. Fiber optic sensors show promise of future applications to three dimensional problems. Discrete element numerical wave simulation has been conducted for saturated granular materials through the introduction of a new contact law using elastohydrodynamic theory. Pore fluid acts to decrease the wave speed and increase the attenuation. Future numerical studies will focus on additional changes of the

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SEARCH CONTROL NO. T4P42J

AD-A279 012 CONTINUED

Interparticle contact response through cementation and particle shape effects

DESCRIPTORS: (U) \*GRANULAR MATERIALS, \*DYNAMIC LOADS, \*PARTICULATES, \*MICROSTRUCTURE, PHOTOELASTICITY, WAVE PROPAGATION, FIBER OPTICS, PARTICLE SIZE, SPATIAL DISTRIBUTION, STRESS STRAIN RELATIONS, SURFACE ANALYSIS, EXPERIMENTAL DATA.

IDENTIFIERS: (U) WUAFOSR2302CS, Cementation, White light speckle photography

AD-A278 989 20/4

OHIO STATE UNIV COLUMBUS DEPT OF MECHANICAL ENGINEERING

(U) Expansion Effects on Supersonic Turbulent Boundary Layers.

DESCRIPTIVE NOTE: Final rept. 1 Sep 91-31 Dec 93,

FEB 94 190P

PERSONAL AUTHORS: Arnette, Stephen A.; Samimy, Mo; Elliott, Gregory S.

REPORT NO. MEMS-94-101

CONTRACT NO. AFOSR-91-0412

PROJECT NO. 2307

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0268, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The effects of various expansion regions on the large scale structure of a Mach 3 fully-developed-turbulent boundary layer are investigated. Five cases are studied: 7 deg and 14 deg centered expansions, 7 deg and 14 deg gradual expansions, and the flat plate. Multi-point surface pressure measurements, filtered Rayleigh scattering visualizations, and double-pulse visualizations were employed. Plan view images of the flat plate boundary layer reveal the presence of the structures of a very large streamwise, and limited spanwise, extent. These structures were found well above the inner layer, nominally at  $n/\delta = 0.5-1.0$ . The structures were also found in the expanded boundary layers. Across the expansion, the large scale structures of the outer layer undergo an increase in scale and incoming boundary layer are quenched by the expansion, while the large scale structures respond more gradually. Convection velocities from the pressure correlations are reasonable in the incoming boundary layer, but unreasonably high in the expanded boundary layers. Convection velocities from correlations of double-pulse images appear reasonable. The discrepancy between the two

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results suggests the relationship between the large scale structures and the convecting pressure field is severely altered by the expansions. Supersonic boundary layer, Turbulence, Expansion effect, Experiment, Filtered rayleigh/mie scattering diagnostics.

DESCRIPTORS: (U) \*SUPERSONIC FLOW, \*TURBULENT BOUNDARY LAYER, ANGLES, CONVECTION, FLAT PLATE MODELS, FLOW VISUALIZATION, IMAGES, MIE SCATTERING, SCHLIEREN PHOTOGRAPHY, REYNOLDS NUMBER, POWER SPECTRA, MOTION, PRESSURE, PULSES, RAYLEIGH SCATTERING, TRANSDUCERS, BOUNDARY LAYER FLOW, SCATTERING, SURFACES, TURBULENCE, VELOCITY.

IDENTIFIERS: (U) WUAFOSR2307AS.

LEHIGH UNIV BETHLEHEM PA DEPT OF MECHANICAL ENGINEERING AND MECHANICS

(U) Unsteady Structure of Leading-Edge Vortices on a Delta Wing.

DESCRIPTIVE NOTE: Final rept. 1 Nov 90-31 Oct 92,

MAR 94 8P

PERSONAL AUTHORS: Rockwell, Donald O.

CONTRACT NO. AFOSR-91-0005

PROJECT NO. 2307

TASK NO. A3

MONITOR: AFOSR, XC  
TR-94-0269, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The overall objective of this research program was to characterize the unsteady flow structure on wings having swept edges. Wings were subjected to global control, involving motion of the entire wing, and local control, involving perturbations at specified locations on the surface of the wing. New types of experimental facilities and image acquisition and processing techniques have allowed determination of the instantaneous vorticity distributions and streamline patterns of the flow. The occurrence of vortex breakdown and stall and their phase shifts relative to the wing motion and to control at the leading-edges have been interpreted in terms of new flow mechanisms. Delta Wings, Vortex Breakdown, Laser Diagnostics

DESCRIPTORS: (U) \*DELTA WINGS, \*LEADING EDGES, \*UNSTEADY FLOW, \*VORTICES, ACQUISITION, CONTROL, FACILITIES, GLOBAL, IMAGES, LASERS, MOTION, PATTERNS, PERTURBATIONS, SURFACES.

IDENTIFIERS: (U) WUAFOSR2307A3.

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CORNELL UNIV ITHACA NY

PROPERTIES, VACUUM, VELOCITY, VIBRATION, ULTRAVIOLET EQUIPMENT.

(U) Photodissociation of OCS at 222 nm: The Triple Channel.

JUL 93

8P

IDENTIFIERS: (U) PE81102F, WJAFOSR2303ES, Branching ratio, Triplet channel, Signlet channel, Chemical physics.

PERSONAL AUTHORS: Nan, G.; Burak, I.; Houston, Paul L.

CONTRACT NO. F49620-92-J-0080

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0286, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in Chemical Physics Letters, v209 n4 p383-389, 9 Jul 93. Available only to DTIC users. No copies furnished by NTIS.

**ABSTRACT:** (U) The dissociation of OCS at 222 nm produces both S(1D) and S(3P). By monitoring the Doppler profile of the minor S(3P2) product on the 3D30 (left arrow) 3p2 transition we have determined that the branching ratio for this triplet channel is 5% relative to the singlet channel. The Doppler profiles change as the angle between the polarization direction of the photolysis light and the propagation direction of the probe light is varied, indicating that the excited state lifetime of the OCS is short compared to its rotation period. Detailed analysis of the Doppler profiles provides an anisotropy parameter of  $\beta = 0.3 \pm 0.2$  and a recoil speed distribution with an average of 37% of the 19,881/cm available energy. The remainder of the energy, 12,525/cm is deposited into CO vibration and rotation. The distributions for both the relative translation and the CO internal energy are broad. Vacuum ultraviolet light, Molecular dynamics, Carbonyl sulfide

**DESCRIPTORS:** (U) \*PHOTODISSOCIATION, \*OXYGEN, \*CARBON, \*SULFUR, ANGLES, ANISOTROPY, CHANNELS, DISTRIBUTION, DYNAMICS, ENERGY, INTERNAL, LIGHT, MONITORING, PARAMETERS, DOPPLER SYSTEMS, PHOTOLYSIS, POLARIZATION, PROBES, PROFILES, PROPAGATION, CARBONYL COMPOUNDS, RATIOS, RECOIL, ROTATION, SULFIDES, TRANSITIONS, REPRINTS, MOLECULAR

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CARNEGIE-MELLON UNIV PITTSBURGH PA ROBOTICS INST

STANFORD UNIV CA DEPT OF AERONAUTICS AND ASTRONAUTICS

(U) Case Based Reasoning in Engineering Design.

(U) Investigation of Burnett Equations for Two-Dimensional Hypersonic Flow.

DESCRIPTIVE NOTE: Final rept. 1 Oct 89-30 Jun 93,

DESCRIPTIVE NOTE: Final rept. 1 Nov 92-31 Oct 93,

JUN 93 134P

APR 94 16P

PERSONAL AUTHORS: Sycara, K.

PERSONAL AUTHORS: Chapman, Dean R.; McCormack, Robert W.

CONTRACT NO. F49620-90-C-0003

CONTRACT NO. F49620-92-J-0012

MONITOR: AFOSR, XC  
TR-94-0280, AFOSR

PROJECT NO. 2307

## UNCLASSIFIED REPORT

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0278, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) Case-Based Problem Solving is based on the idea that problem solving should re-use solutions and other information from previously solved problems instead of relying solely on a base of procedures or rules. The researchers presented a case-based design system, CADET retrieves and re-uses previous successful designs while avoiding previous failures such as poor materials or high cost. The system uses certain behavior-preserving transformation techniques to transform an abstract description of the desired behavior of the device into a description that can be used to find relevant designs in memory. This approach, in effect, decomposes given behavior specifications into 'sub-behaviors', making it possible to recognize parts of previous designs that can be synthesized to form a new device. Currently, the system can perform conceptual design of mechanical devices that exhibit continuous and reciprocating behavior. In addition, since CADET can generate a wide variety of behaviorally equivalent alternative designs for a given set of design specifications, it can be used as a designer's brainstorming assistant.

DESCRIPTORS: (U) \*PROBLEM SOLVING, \*REASONING, \*DESIGN CRITERIA, \*MECHANICAL ENGINEERING, \*COMPUTER AIDED DESIGN, \*KNOWLEDGE BASED SYSTEMS, APPROACH, COSTS, FAILURE, HIGH COSTS, MATERIALS, SPECIFICATIONS, ALGORITHMS, COMPUTER PROGRAMS, DATA BASES.

IDENTIFIERS: (U) CADET Computer program, Case based reasoning

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ABSTRACT: (U) Two separate areas of investigation are explored of two-dimensional flow fields computed from the Burnett and Navier-Stokes equations: evaluation of various forms of Burnett equations from computations of 1-D hypersonic shock structure and 2-D flow over a flat plate at zero incidence; and investigation of the interaction at high altitudes of a hypersonic oblique shock impinging on a cowl lip. Among five different formulations of Burnett equations, two were found to exhibit in shock structure a small region of flow wherein the heat flux is physically unreal. Preliminary computations with the three other formulations are made for flow over a flat plate. It is found that the well-known severe overheating, due to oblique shock impingement on a leading edge, decreases significantly as altitude increases, disappearing at Knudsen numbers above about 0.1. Burnett Equations, Hypersonic flow, Shock structure, Shock on cowl lip interaction

DESCRIPTORS: (U) \*FLOW FIELDS, \*HYPERSONIC FLOW, \*SHOCK WAVES, FORMULATIONS, HEAT FLUX, HIGH ALTITUDE, LEADING EDGES, NAVIER STOKES EQUATIONS, ONE DIMENSIONAL, BLUNT BODIES, COMPUTATIONAL FLUID DYNAMICS, MACH NUMBER, AEROTHERMODYNAMICS, KNUDSEN NUMBER, TWO DIMENSIONAL FLOW.

IDENTIFIERS: (U) PE61102F, WUAFOSR2307AS, \*Burnett



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equations.

AD-A278 941 21/2

PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF  
MECHANICAL ENGINEERING

(U) Detailed Studies of Soot Formation in Laminar  
Diffusion Flames for Application to Modeling Studies.

DESCRIPTIVE NOTE: Annual rept. 1 Feb 93-31 Jan 94,

APR 94 96P

PERSONAL AUTHORS: Santoro, Robert J.

CONTRACT NO. F49620-92-J-0161

PROJECT NO. 2308

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0264, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) An investigation of soot formation in laminar diffusion flames has shown that soot particle surface growth under laminar diffusion flame conditions ceases because of the depletion of hydrocarbon species, in particular acetylene and benzene, and not due soot particle reactivity loss due to thermal aging of the particles. This results has been obtained through direct species concentration measurements under well controlled conditions while the particle reactivity effects were calculated based on premixed flame results along with particle temperature/time information available from earlier laminar diffusion flame studies. Comparisons with a soot formation model which incorporated detailed chemistry effects showed good agreement in terms of predicted and measured species concentration and soot particle field evolution. In addition, a novel technique for measuring soot volume fraction has been developed based on laser-induced incandescence and applied to similar laminar diffusion flame, studies with good success. This technique represents a major development in terms of its ability to make soot volume fraction measurements in unsteady inhomogeneous combusting flows. Soot formation, Soot particles, Diffusion flames

DESCRIPTORS: (U) \*FLAMES, \*SOOT, ACETYLENES, BENZENE,

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COMPARISON, HYDROCARBONS, INCANDESCENCE, MEASUREMENT, REACTIVITIES, VOLUME, LAMINAR FLOW, CONCENTRATION(COMPOSITION), COMBUSTION PRODUCTS, SURFACE ANALYSIS, SPATIAL DISTRIBUTION, THERMAL DIFFUSION, QUANTITATIVE ANALYSIS, AGING(MATERIALS).

CORNELL UNIV ITHACA NY DEPT OF CHEMISTRY

(U) Vacuum Ultraviolet Studies of Molecular Dynamics.

DESCRIPTIVE NOTE: Final rept. 1 Feb 92-30 Jan 94,

IDENTIFIERS: (U) PE61102F, WUAFOSR2308BS, Laminar diffusion flames.

APR 94 7P

PERSONAL AUTHORS: Houston, Paul L.

CONTRACT NO. F49620-92-J-0080

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0277, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Tunable vacuum ultraviolet radiation generated by four-wave mixing will be used to probe collisional energy transfer and photodissociation. Collisional relaxation of the S((1)D) velocity distribution by rare gases has been measured to learn to what extent this simple process can be described by a hard-sphere, elastic interaction. E yielding V transfer was studied from S((1)D) to CO and N<sub>2</sub>, both by examining the Doppler profile of the relaxed atoms and by direct measurement of the CO(V,J) distribution. Finally, the photodissociation of O<sub>3</sub> and N<sub>2</sub>O have been investigated by monitoring the Doppler profiles of the resulting O((1)D) lines. This integrated program of molecular dynamics studies using vacuum ultraviolet radiation has enhanced our knowledge both of the chemical physics of these basic processes and of the interaction of high energy photons with small molecules found in the upper atmosphere. Vacuum Ultraviolet Light, Molecular Dynamics, Ozone, Nitrous Oxide, CO

DESCRIPTORS: (U) \*PHOTODISSOCIATION, \*VACUUM ULTRAVIOLET RADIATION, ATOMS, DISTRIBUTION, ENERGY TRANSFER, FOUR WAVE MIXING, HIGH ENERGY, MONITORING, NITROUS OXIDE, OZONE, PHOTONS, PROBES, RARE GASES, UPPER ATMOSPHERE, VELOCITY, CARBON MONOXIDE, MOLECULE MOLECULE INTERACTIONS, PARTICLE COLLISIONS, REACTION KINETICS, ANISOTROPY, MOLECULAR STRUCTURE.

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CALIFORNIA INST OF TECH PASADENA

IDENTIFIERS: (U) PEG1102F, PEAFOSR2303ES.

(U) Ultrafast Chemical Dynamics of Reactions in Beams.

DESCRIPTIVE NOTE: Final rept. 1 Nov 89-31 Oct 93,

APR 94 29P

PERSONAL AUTHORS: Zevail, Ahmed H.

CONTRACT NO. AFOSR-90-0014

MONITOR: AFOSR, XC  
Tr-94-0276, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The research in this proposal focused on the development of femtosecond laser techniques and their applications in the studies of molecular dynamics in real time. The research resulted in some thirty-seven publications with the involvement of more than twenty-five graduate students, post-doctoral fellows, and visiting associates from the U.S. and abroad.

DESCRIPTORS: (U) \*LASERS, \*CHEMICAL REACTIONS, \*MOLECULAR BEAMS, DYNAMICS, REAL TIME, STUDENTS, MOLECULAR PROPERTIES, PROBES, OPTICAL EQUIPMENT, IODINE, MASS SPECTROMETRY.

IDENTIFIERS: (U) \*Ultrafast, \*Chemical dynamics, Femtosecond, 6fs Duration

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A278 938 20/6.1

AD-A278 886 4/1

COLUMBIA UNIV NEW YORK

COLUMBIA UNIV NEW YORK DEPT OF APPLIED PHYSICS

(U) Theoretical Studies of Ultrashort Phenomena.

(U) Collisionless Dynamics of the Magnetosphere.

DESCRIPTIVE NOTE: Final rept. 1 May-30 Sep 93,

DESCRIPTIVE NOTE: Annual rept. 1 Jan-31 Dec 93,

NOV 93

7P

AUG 93 41P

PERSONAL AUTHORS: Potaske, M. J.

PERSONAL AUTHORS: Bhattacharjee, Amitava

CONTRACT NO. F49620-93-1-0277

CONTRACT NO. F49620-93-1-0071

PROJECT NO. 2304

PROJECT NO. 2311

TASK NO. BS

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0272, AFOSR

MONITOR: AFOSR, XC  
TR-94-0271, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) With the advent of new laser sources, considerable interest has been focussed on the interaction of femtosecond optical pulses with nonlinear media. We find conditions for femtosecond solitons and demonstrate that they differ in their velocity and phase from the traditional solitons. We investigate physical properties for their experimental observation. Femtosecond optics, Nonlinear optics, Nonlinear partial differential equations

ABSTRACT: (U) Experiment: An energetic electron belt has been created in a laboratory terrella for the first time. Measurements indicate the trapped-electron belt to be localized in radius and have a non-Maxwellian energy distribution ranging from 10 to 40 keV. Using multiple probes, we have clearly identified drift-resonant instabilities leading to rapid radial transport. Transport in a dipole appears to require multiple modes, and its bursty nature suggests a profile relaxation of the energetic electrons which self-stabilizes the drift-resonant instabilities. Theory, Substorms in the magnetosphere cause the generation of major electromagnetic disturbances and energetic particles. We examine the role of the collisionless tearing-instability as a possible mechanism for substorms. Global asymptotic magnetotail equilibria which are slowly varying in the Earth-Sun direction are constructed, including all three components of the magnetic field. Some of these equilibria are analyzed for stability with respect to collisionless electron tearing modes. It is found that the ion tearing instability, which has been widely invoked as a possible trigger for substorms, does not exist. The By field is demonstrated to have a destabilizing effect on electron tearing modes. Regimes in which collisionless tearing modes can grow are delineated.

DESCRIPTORS: (U) \*NONLINEAR OPTICS, \*SOLITONS, \*INFRARED PULSES, INTERACTIONS, PARTIAL DIFFERENTIAL EQUATIONS, PHASE, PHYSICAL PROPERTIES, VELOCITY, PULSED LASERS, SHORT RANGE(TIME), DISPERSIONS, FIBER OPTICS, OPTICAL SWITCHING.

IDENTIFIERS: (U) WJAFOSR2304BS, PEB1102F, \*Femtosecond optics, Femtosecond time.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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DESCRIPTORS: (U) \*MAGNETOSPHERE, BELTS, DIPOLES, DISTRIBUTION, DRIFT, ELECTRONS, ENERGY, GLOBAL, INSTABILITY, IONS, LABORATORIES, MAGNETIC FIELDS, MEASUREMENT, PARTICLES, PROBES, PROFILES, RELAXATION, STABILITY, SUN, TEARING, THEORY, TIME, TRANSPORT.

CALIFORNIA UNIV DAVIS DEPT OF ENVIRONMENTAL TOXICOLOGY

(U) Biomarkers of Exposure: Molecules to Ecosystem.

DESCRIPTIVE NOTE: Annual rept. 1 May 92-30 Apr 93.

APR 93 6P

IDENTIFIERS: (U) PEG1102F

PERSONAL AUTHORS: Wilson, Barry W.

CONTRACT NO. AFOSR-91-0226

PROJECT NO. 3484

TASK NO. RS

MONITOR: AFOSR, XC  
TR-94-0274, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Our work has focussed on the occurrence, properties, and fate of two groups of organic soil contaminants which exist at U.S. military bases: Organophosphate esters, which are used as hydraulic fluids in aircraft and other heavy equipment, and as plasticizers and lubricants, and trinitotoluene and derivative, which are used in munitions. The progress reported here has been done almost exclusively at the University of Nevada although conceptualization and planning were done at University of California, Davis.

DESCRIPTORS: (U) \*HYDRAULIC FLUIDS, \*ORGANOPHOSPHATES, \*BACTERIA, \*CHEMICALS, \*ENZYMES, \*LABORATORIES, \*ENVIRONMENTAL IMPACT, AIRCRAFT, CALIFORNIA, CONTAMINANTS, ESTERS, FLUIDS, HYDRAULICS, LUBRICANTS, NEVADA, ORGANIC SOILS, PLANNING, PLASTICIZERS, SOILS, UNIVERSITIES, WORK, TOXICITY, ECOSYSTEMS, TEMPERATURE.

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AD-A278 774 CONTINUED

DAVID SARNOFF RESEARCH CENTER PRINCETON NJ

(U) Multidisciplinary Studies of Integrated Neural Network Systems.

DESCRIPTIVE NOTE: Final rept. 1 Dec 89-31 Dec 93,

MAR 94 38P

PERSONAL AUTHORS: Pearson, John; Spence, Clay; Sullivan, Williams E.; Lubin, Jeffrey; Gelfand, Jack

CONTRACT NO. F49620-90-C-0010, ARPA Order-7013

PROJECT NO. 7013

TASK NO. 10

MONITOR: AFOSR, XC  
TR-94-0252, AFOSR

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Prepared in cooperation with Princeton Univ., NJ and Robicon, Inc., Princeton, NJ.

ABSTRACT: (U) This project was a joint effort of the David Sarnoff Research Center (Sarnoff), Princeton University, and Robicon Systems, all of Princeton, NJ. It consisted of three sub-projects, each concerned with a similar kind of research - the development of artificial adaptive systems with capabilities similar to those of their biological counterparts. Recent work on neural networks has demonstrated their potential for solving difficult problems in simplified, controlled environments. The next stage in the development of neural networks is their extension to the scale, complexity, and variability of real-world situations. This will not be a simple evolution of existing neural net designs, because it requires the integration of complex adaptive systems whose components have widely differing functions. Fortunately, biological organisms present existing solutions to this problem and neuroscience can now probe in detail the relevant structures. Biological systems are highly adaptive and operate well in extremely complex and variable environments. They accomplish this by partitioning the system into functional sub-units in a quasi-hierarchical structure of neural network modules.

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We studied three specific examples of this system integration strategy and modeled their operation for the purpose of creating new neural network architectures and control schemes. Neural networks, Auditory localization, Sensor fusion, Neuroscience, Target detection, Motion analysis, Visual cortex, Barn owl, Robotics, Expert systems, Hierarchical architectures, Adaptive control.

DESCRIPTORS: (U) \*NEURAL NETS, \*CENTRAL NERVOUS SYSTEM, \*ADAPTIVE CONTROL SYSTEMS, \*INTEGRATED SYSTEMS, ARCHITECTURE, DETECTION, ENVIRONMENTS, EXPERT SYSTEMS, INTEGRATION, MOTION, NETWORKS, OPERATION, PROBES, ROBOTICS, SCALE, STRATEGY, TARGET DETECTION, TARGETS, VARIABLES, VISUAL CORTEX, COMPUTERIZED SIMULATION, SIGNAL PROCESSING, PROBLEM SOLVING, KNOWLEDGE BASED SYSTEMS.

IDENTIFIERS: (U) PE81101E, WUAFOSR701310, Barn owls.

UNCLASSIFIED

DTIC REPORT BIBLIOGRAPHY

SEARCH CONTROL NO. T4P42J

AD-A278 753 17/9 17/5.1 12/5  
CONNECTICUT UNIV STORRS DEPT OF ELECTRICAL AND SYSTEMS  
ENGINEERING

(U) Estimation with Multisensor/Multiscan Detection Fusion.

DESCRIPTIVE NOTE: Final rept. 1 Mar 93-1 Mar 94.

MAR 94 12P

PERSONAL AUTHORS: Bar-Shalom, Y.; Pattipati, K. R.

CONTRACT NO. F49620-93-1-0164

MONITOR: AFOSR, XC  
TR-94-0251, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) In this report we deal with the following topics: Data Association for Heterogeneous Sensors; Efficient L-D Factorization Methods for PDA, IMM and IMPDA Filters; Tracking with Debiased Consistent Converted Measurements; Stabilization of Jump Linear Gaussian Systems; Ballistic Missile Track Initiation from Satellite Observations; Beam Pointing Control of a Monopulse Radar for Maneuvering Target Tracking; Target Tracking with Glint Noise; Image Segmentation Based on Optimal Layering for Precision Tracking; Performance Studies of AMSS with Multiple Part Types; Markov-Reward Models and Hyperbolic Systems; and Estimation and Tracking; Principles, Techniques, and Software. Tracking, Assignment, Control.

DESCRIPTORS: (U) \*MONOPULSE RADAR, \*INFRARED SCANNING, ARTIFICIAL SATELLITES, CONTROL, GLINT, GUIDED MISSILES, PRECISION, STABILIZATION, TARGETS, RADAR TRACKING, OPTIMIZATION, BALLISTIC TRAJECTORIES, KALMAN FILTERING, ASSOCIATIVE PROCESSING, BACKGROUND NOISE, IMAGE PROCESSING, INTERACTIVE GRAPHICS.

IDENTIFIERS: (U) LD Factorization methods, AMS(Automated Manufacturing Systems), PDA(Probabilistic Data Association), IMM(Interacting Multiple Model), Square root factorization methods, EKF(Extended Kalman Filter), JL(Jump Linear).

AD-A278 753

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AD-A278 739 21/3 20/4

OHIO STATE UNIV COLUMBUS DEPT OF MECHANICAL ENGINEERING  
(U) Recovery of Frozen Flow Losses in Arcjets.

DESCRIPTIVE NOTE: Final rept. 1991-1993,

MAR 94 82P

PERSONAL AUTHORS: Subramaniam, V. V.; Babu, V.; Aithal, S.

CONTRACT NO. AFOSR-91-0318

PROJECT NO. 2308

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0259, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This research explores ways of reducing frozen flow losses via state-resolved numerical simulations (quasi 1-D, 2D, and 2D with swirl). Frozen flow losses in molecular vibration, rotation, and electronic excitation are believed to account for significant losses in thrust and efficiency of arcjet thrusters. This report summarizes the accomplishments in the first two years of a four year research program designed to quantify frozen flow losses, and to generate design tools useful for the designer to enhance arcjet performance. Frozen flow losses, Arcjets, Plasma thrusters, Numerical simulations, Supersonic reacting flows.

DESCRIPTORS: (U) \*ARC JET ENGINES, \*THRUSTERS, \*ELECTRIC PROPULSION, EFFICIENCY, EXCITATION, LOSSES, SUPERSONIC FLOW, MOLECULAR VIBRATION, ROTATION, SIMULATION, THRUST, VIBRATION, MATHEMATICAL MODELS, PLASMAS(PHYSICS), ARTIFICIAL SATELLITES, KINETIC ENERGY, ENERGY TRANSFER, ELECTRIC POWER, CONTOURS, TEMPERATURE, MACH NUMBER, VISCOUS FLOW, AEROSPACE CRAFT.

IDENTIFIERS: (U) WUAFOSR2308AS, PEB1102F, Swirling flow, \*Frozen flow.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A278 717 20/5

AD-A278 716 11/9 11/4 20/11 12/1

CALIFORNIA UNIV LOS ANGELES

NORTHWESTERN UNIV EVANSTON IL

(U) Pseudospectral Moller-Plesset Perturbation Theory  
Through Third Order,

(U) Computational Methods for Material Failure Processes,

DESCRIPTIVE NOTE: Final rept. 1 Sep 90-31 Dec 93,

MAR 94 9P

FEB 94 64P

PERSONAL AUTHORS: Martinez, Todd J.; Carter, Emily A.

PERSONAL AUTHORS: Belytschko, Ted

PROJECT NO. 2303

CONTRACT NO. AFOSR-90-0340

TASK NO. FS

MONITOR: AFOSR, XC

MONITOR: AFOSR, XC  
TR-94-0260, AFOSR

MONITOR: AFOSR, XC  
TR-94-0253, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Chemical Physics, v100 n5  
p3631-3638, 1 Mar 94. Available only to DTIC users. No  
copies furnished by NTIS.

ABSTRACT: (U) We present a formulation and  
implementation of Moller-Plesset perturbation theory in a  
pseudospectral framework. At the second-order level, the  
pseudospectral formulation is a formally a factor of  $N/n$   
faster than conventional approaches, while the third  
order is formally faster by a factor of  $n$ , where  $N$  is the  
number of atomic orbitals and  $n$  is the number of occupied  
orbitals. The accuracy of the resulting energies is  
probed for a number of test cases. Practical timings are  
presented and show conclusively that the pseudospectral  
formulation is faster than conventional ones.

DESCRIPTORS: (U) \*ATOMIC ORBITALS, \*PERTURBATION THEORY,  
\*MOLECULAR ORBITALS, FORMULATIONS, ATOMIC ENERGY LEVELS,  
MOLECULE MOLECULE INTERACTIONS, TEST AND EVALUATION,  
ELECTRON MOBILITY, EXCITATION, HARTREE FOCK APPROXIMATION,  
WAVE FUNCTIONS, REPRINTS.

IDENTIFIERS: (U) PE81102F, WUAFOSR2303FS.  
\*Pseudospectral formulation, Moeller Plesset perturbation  
theory.

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ABSTRACT: (U) Computational Methods are developed for  
failure problems such as shear banding. H-Adaptive  
procedures for the finite element solution of transient  
solid mechanics problems are studied, with particular  
emphasis on problems involving localization due to  
material instability. Various types of error criteria are  
examined and it is shown that for problems involving  
plastic response or localization, an error criterion  
based on an L2 projection of strains is the most  
effective for the constant strain elements considered  
here. Examples of one dimensional and two dimensional  
localization (shear band formation) problems are given.  
Massively parallel computations are performed to study  
the effects of imperfections on shear band morphology  
Finite elements, Material instability shear bands.

DESCRIPTORS: (U) \*COMPUTATIONS, \*FAILURE, \*MATERIALS,  
CONSTANTS, ERRORS, INSTABILITY, MECHANICS, MORPHOLOGY,  
ONE DIMENSIONAL, PLASTICS, RESPONSE, SOLIDS, TRANSIENTS,  
TWO DIMENSIONAL, FINITE ELEMENT ANALYSIS, SHEAR  
PROPERTIES.

IDENTIFIERS: (U) Shear band formation, H-Adaptive,  
Localization.



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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A278 714 12/7 PENNSYLVANIA UNIV PHILADELPHIA  
 (U) Parallel Decompositions for Network-Structured Problems.  
 GENERAL ELECTRIC CORPORATE RESEARCH AND DEVELOPMENT  
 SCHENECTADY NY GENERAL PH YSICS LAB

AD-A278 711 21/2 7/3 20/4 12/7

(U) Parallel Simulations of Partially Stirred Methane Combustion.

DESCRIPTIVE NOTE: Final rept. 1 Feb 91-30 Sep 93,

APR 94 7P

PERSONAL AUTHORS: Zenols, Stavros

CONTRACT NO. AFOSR-91-0188

PROJECT NO. 2304

TASK NO. DS

MONITOR: AFOSR, XC  
 TR-94-0261, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Advances in parallel optimization for network structured problems have been applied to a variety of important real-world problems including military personnel readiness and portfolio optimization.

DESCRIPTORS: (U) \*DECOMPOSITION, \*NETWORK ANALYSIS(MANAGEMENT), MILITARY PERSONNEL, OPTIMIZATION, STATE OF THE ART, COMPUTER NETWORKS, PROBLEM SOLVING, COMBAT READINESS.

IDENTIFIERS: (U) WUAFOSR2304DS.

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DESCRIPTIVE NOTE: Journal article,

SEP 93 19P

PERSONAL AUTHORS: Correa, Sanjay M.; Braaten, Mark E.

CONTRACT NO. F49620-91-C-0072

PROJECT NO. 2308

TASK NO. BS

MONITOR: AFOSR, XC  
 TR-94-0258, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Combustion and Flame, v94 p469-486 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Premixed methane combustion in a partially stirred reactor (PaSR) is studied numerically. The effects of turbulent stirring rate on NO, CO, and other quantities are computed. The chemistry is represented by a 'full' scheme (27 species, 77 reactions) in the baseline study. Turbulence is accounted for by the 'IEM' (Interaction-by-Exchange-with-the-Mean) sub-model. The PaSR is described by a system of  $(N_s + 1) \times N_p$  first-order coupled o.d.e.'s in time, where  $N_s$  equivalent number of species, and  $N_p$  equivalent number of particles. The model is well suited to parallel computers, without which the present study would not have been practical. The speedup over serial computers is essentially linear in the number of processors used, until the number of particles per processor becomes small enough ( $< 10$ ) to affect load balance. The conditions are: 30 atm, 1200K inlet temperature, 800K equilibrium temperature rise, and 2 ms reactor residence time (in the PSR limit). In the PSR limit the flow just starts to ignite, while in the PSR limit temperatures are very near equilibrium. PaSR simulations are conducted in the range 100 5,000 Hz

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(mixing frequency), and in each case converge to a stochastic steady state and span the PFR-PSR limits smoothly. The correlation of NO with particle age decreases as frequency increases, and is within expected limits. The OH levels are uniform to within a factor of two in this frequency range, which is consistent with the 'distributed' OH structures observed in turbulent diffusion flames. Simulations with a 25-step 'skeletal' scheme agreed well with the baseline study above 1,000 Hz, but are about 400K low on mean temperature at 100 Hz. Turbulent combustion, Monte Carlo pdf model, Finite-rate chemistry, Mixing, Parallel computing.

DESCRIPTORS: (U) \*COMBUSTION, \*METHANE, \*SIMULATION, \*PARALLEL PROCESSING, BALANCE, CHEMISTRY, COMPUTERS, CORRELATION, EXCHANGE, FLAMES, FLOW, FREQUENCY, INLETS, INTERACTIONS, MEAN, MIXING, MODELS, NUMBERS, PARTICLES, QUANTITY, RATES, STEADY STATE, STRUCTURES, TEMPERATURE, TIME, TURBULENT DIFFUSION, REPRINTS, HYDROXYL RADICALS.

IDENTIFIERS: (U) PEB1102F, WUAFOSR2308BS, Partially stirred, Monte Carlo pdf model, Finite-rate chemistry, PSR(Perfectly Stirred Reactor).

AD-A278 710 7/2 11/4 20/2 20/11

GENERAL ELECTRIC CO CINCINNATI OH AIRCRAFT ENGINE BUSINESS GROUP

(U) Strain Aging Embrittlement of the Ordered Intermetallic Compound NiAl.

93 9P

PERSONAL AUTHORS: Brzeski, J. M.; Hack, J. E.; Darolia, R.; Field, R. D.

CONTRACT NO. F49820-91-C-0077

PROJECT NO. 2306

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0262, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Materials Science and Engineering, A170 p11-18 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The deformation behavior and fracture toughness of single crystals of the ordered intermetallic compound NiAl were investigated as functions of relatively low temperature thermal treatments. A strain aging embrittlement phenomenon, similar to that observed in mild steels, was identified. In the non-embrittled condition, tensile ductilities on the order of 7%-8% and fracture toughness values of 15-17 MPa m<sup>1/2</sup> were obtained for crystals with a (110) axis tested at room temperature. Additional observations of serrated yielding during compression testing at temperatures between 100 and 200 deg C are consistent with strain aging induced by the low temperature diffusion of interstitial impurities or constitutional vacancies to dislocations, thus rendering them immobile at room temperature.

DESCRIPTORS: (U) \*AGING(MATERIALS), \*EMBRITTEMENT, \*INTERMETALLIC COMPOUNDS, COMPRESSION, DEFORMATION, DIFFUSION, REPRINTS, STRAIN(MECHANICS), DISLOCATIONS, IMPURITIES, INTERSTITIAL, LOW TEMPERATURE, NICKEL, ALUMINIDES, THERMAL PROPERTIES, ROOM TEMPERATURE, SINGLE CRYSTALS, TOUGHNESS, TENSILE PROPERTIES, DUCTILITY,

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TURBINES, ROCKET ENGINES, COMPOSITE MATERIALS.

IDENTIFIERS: (U) PE81102F, WUAFQSR2308AS, Ordered,  
Fractures.

AD-A278 709 3/2 20/6

HARVARD COLL OBSERVATORY CAMBRIDGE MA

(U) Absolute, Extreme Ultraviolet Solar Spectral  
Irradiance Monitor (AESSIM).

DESCRIPTIVE NOTE: Annual rept. no. 3, 15 Nov 91-14 Nov 92,

MAR 94 3P

PERSONAL AUTHORS: Parkinson, W. H.; Smith, Peter L.

CONTRACT NO. AFOSR-90-0063

PROJECT NO. 2310

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0254, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Several AESSIM mission concepts which involve spectrometers on rocket underflights and those on the Voyager spacecraft have been considered. We have studied a low-pressure version of the EUV radiance standard of Hollandt, Huber & Kuhne (Appl. Opt. 33, 68, 1994) and concluded that a substantial redesign of it would be required if a suitable one is to be developed for in-orbit calibration of a solar spectral irradiance monitor. We have reviewed the use, suitability, and the availability of thin film filters for in-orbit EUV calibration. In our opinion, the availability of space-qualified filters has not been verified. We have evaluated and chosen a design of a 4-spectrograph, flat-field package that provides 0.1 to 0.2 nm resolution in the range 5-175 nm with a total weight including detectors (without electronics) of 1.6 Kg. Solar, Extreme-ultraviolet, Radiometric calibration.

DESCRIPTORS: (U) \*ULTRAVIOLET RADIATION, \*SOLAR RADIATION, CALIBRATION, DETECTORS, FILTERS, LOW PRESSURE, MONITORS, ORBITS, PRESSURE, RADIANCE, ROCKETS, SPECTROGRAPHS, SPECTROMETERS, THIN FILMS, UNMANNED SPACECRAFT, RADIONETRY, IRRADIATION.

IDENTIFIERS: (U) VOYAGER Spacecraft, Extreme ultraviolet radiation.

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AD-A278 708 CONTINUED

ROCHESTER UNIV NY DEPT OF COMPUTER SCIENCE

Proposed work has practical applications in monitoring and surveillance, and as a component of a sophisticated visual system.

(U) Detection, Stabilization, and Identification of Moving Objects by a Moving Observer.

DESCRIPTIVE NOTE: Final rept..

MAR 92 45P

DESCRIPTORS: (U) \*MOTION, \*IMAGE PROCESSING, \*VISUAL PERCEPTION, ANIMALS, APPROACH, CONTRAST, FLOW, FLUID FLOW, FLUIDS, IDENTIFICATION, IMAGES, MONITORING, MOTIVATION, OBSERVATION, PLATFORMS, RECOGNITION, RIPPLES, STATIONARY, SURVEILLANCE, TEST AND EVALUATION, TEXTURE, TREES, WATER, WORK, TEXTURE.

PERSONAL AUTHORS: Nelson, Randal

CONTRACT NO. AFOSR-91-0288

IDENTIFIERS: (U) WUAFOSR2304A7, Temporal texture.

PROJECT NO. 2304

TASK NO. A7

MONITOR: AFOSR, XC  
TR-94-0250, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The stated goal of the research was to demonstrate that robustly computable motion features can be used directly as a means of detecting and recognizing moving objects. Specifically, the goal was to design, implement, and test a general framework for detecting movement from a moving Platform, and recognizing both distributed motion activity on the basis of temporal texture, and complexly moving, compact objects on the basis of their action. This recognition approach contrasts with the reconstructive approach that has typified most prior work on motion. The underlying motivation is the observation that, for objects that typically move, it is frequently easier to identify them when they are moving than when they are stationary. Specifically, in the case of temporal texture, the researchers proposed to extract statistical spatial and temporal features from approximations to the motion field and use techniques analogous to those developed for grayscale texture analysis to classify regional activities such as windblown trees, ripples on water, or chaotic fluid flow, that are characterized by complex, non-rigid motion. For action identification, they proposed to use the spatial and temporal arrangement of motion features in conjunction with simple geometric image analysis to identify complexly moving objects such as machinery and locomoting people and animals. The

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AD-A278 703 9/1 20/2 11/4

AD-A278 703 CONTINUED

MARTIN MARIETTA LABS SYRACUSE NY

(U) Low Temperature Materials.

DESCRIPTIVE NOTE: Final tech rept. Jun 91-Jan 94,

MAR 94 59P

PERSONAL AUTHORS: Ballingall, J. M.; Ho, P.; Mazurowski,  
J.; Lester, L.; Hwang, K. C.

CONTRACT NO. F49620-91-C-0044

PROJECT NO. 2305

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0231, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) InGa<sub>1-x</sub>As (x=0.25-0.35) grown at low temperature on GaAs by molecular beam epitaxy is characterized by Hall effect, transmission electron microscopy, and ultrafast optical testing. As with low temperature (LT) GaAs, the resistivity is generally higher after a brief anneal at 600 deg C. High-resolution transmission electron microscopy shows all the as-grown epilayers grown directly on GaAs to be heavily dislocated due to the large lattice mismatch (2-3%). Annealed layers also show precipitate formation, in addition to the dislocations. Like LT GaAs, In(x)Ga(1-x)As lifetimes shorten as growth temperatures are reduced; and LT In(x)Ga(1-x)As lifetimes are generally shorter in as-grown samples than in annealed samples. The metal-semiconductor-metal photodetectors we fabricated on the material exhibit response times of 1-3 picoseconds, comparable to results reported on GaAs grown at low temperature, and the fastest ever reported in the wavelength range of 1.0-1.3 microns. To improve the crystalline quality and to distinguish detector speed and responsivity limitations due to dislocations versus defects induced by LT growth, we have grown 3microns-thick graded layers of In(x)Al(1-x)As between the GaAs substrates and In(0.35)Ga(0.65)As films. The In(x)Al(1-x)As layers are heavily dislocated, with the dislocation density increasing with distance from the GaAs substrate, and abruptly terminating at or

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below the In(0.35)Ga(0.65)As layer. Epitaxy, AlGaAs-InGaAs-GaAs, Pseudomorphic heterostructures, Strained layer superlattices, Dislocations, Photoluminescence, Hall effect, Electron diffraction, Photoreflectance.

DESCRIPTORS: (U) \*GALLIUM ARSENIDES, \*LOW TEMPERATURE, \*MATERIALS, \*SEMICONDUCTORS, \*COMPOSITE MATERIALS, DENSITY, DETECTORS, DISLOCATIONS, ELECTRON MOBILITY, SUPERLATTICES, ELECTRODES, ELECTRON DIFFRACTION, LAYERS, MICROSCOPY, FILMS, HALL EFFECT, HIGH RESOLUTION, LIMITATIONS, METALS, MOLECULAR BEAMS, PHOTODETECTORS, PHOTOLUMINESCENCE, PRECIPITATES, QUALITY, REDUCTION, RESOLUTION, RESPONSE, STOPPING, SUBSTRATES, TEMPERATURE, VELOCITY, EPITAXIAL GROWTH, OPTICS, ANNEALING, LATTICE DYNAMICS, CRYSTALS.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2307BS, Transmission, Epilayers, Lattice mismatch, Ultrafast, Photoreflectance, Pseudomorphic heterostructures, Strained layers.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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S I DIAMOND TECHNOLOGY INC HOUSTON TX

RESPONSE, STAGNATION TEMPERATURE, PRESSURE, STATICS,  
WEIGHT, JET FLOW, DRAG, PRESSURE DISTRIBUTION, LABORATORY  
TESTS, EXPERIMENTAL DATA.

(U) An Experimental Investigation of Active Control of  
Thrust Vectoring Nozzle Flow Fields.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2307BS, Counterflow.

DESCRIPTIVE NOTE: Final rept. 15 Jul 92-15 Jul 93.

JAN 94 32P

PERSONAL AUTHORS: Strykowski, P. J.; Krothapalli, A.

CONTRACT NO. F49620-92-J-0426

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0162, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Fluidic thrust vector control is examined in a supersonic rectangular jet having a 4:1 aspect ratio. Experiments conducted at a Mach number of 2 reveal that the thrust vector angle of the jet can be continuously varied by up to at least 16 deg by applying a counterflowing stream to one of the primary jet shear layers. A technique using counterflow eliminates the bistable response known to plague fluidic elements and is shown to be effective in both hot and cold supersonic jets. Results are presented for jet stagnation temperatures between 300 deg K and 870 deg K. Measurements indicate that the thrust vector control is both efficient as well as a linear function of the static pressure developed in the counterflowing stream. The typical power required to vector the jet at 16 degrees was estimated to be less than 1% of the power developed in the primary jet. Thrust vector control employing counterflow has several advantages over current technologies, the most important of which is the elimination of movable control surfaces which add considerable weight to the aircraft. Thrust vectoring nozzle, Active control.

DESCRIPTORS: (U) \*FLUIDICS, \*FLOW FIELDS, \*SUPERSONIC  
NOZZLES, \*THRUST VECTOR CONTROL SYSTEMS, ASPECT RATIO,  
CONTROL SURFACES, ELIMINATION, MACH NUMBER, POWER,

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42U

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PURDUE UNIV LAFAYETTE IN SCHOOL OF AERONAUTICS AND  
ASTRONAUTICS DETECTORS, DEFORMATION, FLIGHT.  
(U) Aeroservoelastic Tailoring with Piezoelectric IDENTIFIERS: (U) Tailoring.  
Materials: Actuator Optimization Studies.

DESCRIPTIVE NOTE: Final rept. 1 Oct 91-30 Sep 93,

FEB 94 48P

PERSONAL AUTHORS: Weisshaar, Terrence A.; Rotea, Mario A.

REPORT NO. AERO-3

MONITOR: AFOSR, XC  
TR-94-0263, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) This report summarizes aeroservoelastic tailoring studies in which adaptive material actuators are used to control structural deflection of aeroelastic systems. The problem is to furnish enough directed control of a system to make the control of the phenomenon feasible. Specific research problems considered are: choice of the actuator material for effective control; geometric arrangement for active control; and optimum coverage of surface panels for effective control. A specific method of controller design is suggested to determine the limits of control. It is applied to a typical section whose response to random atmospheric turbulence is to be controlled. A finite element method is developed to model actuator and sensor output for plate-like actuators and its use is illustrated for wing-like configurations to demonstrate the benefits of orthotropic material actuators. Finally, the problem of optimum actuators to supply deflection of panels for wing surfaces is examined to determine optimality criteria for such panels and to use strain energy as a guide for efficient use of actuator/host plate combinations. Piezoelectric actuators, Aeroservoelasticity.

**DESCRIPTORS:** (U) \*ACTUATORS, \*AEROSERVOELASTICITY, \*MATERIALS, \*WINGS, \*ADAPTIVE SYSTEMS, \*LIFTING SURFACES, ATMOSPHERIC MOTION, CONFIGURATIONS, CONTROL, DEFLECTION, ENERGY, MODELS, OUTPUT, PANELS, PLATES, RESPONSE, SELECTION, SUPPLIES, SURFACES, TURBULENCE, PIEZOELECTRICITY, OPTIMIZATION, FINITE ELEMENT ANALYSIS,

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PENNSYLVANIA UNIV PHILADELPHIA SCHOOL OF ENGINEERING AND  
APPLIED SCIENCE

DESCRIPTORS: (U) \*SOFTWARE ENGINEERING, \*MAN COMPUTER  
INTERFACE, RELIABILITY, DATA ACQUISITION, COMPUTER  
OPERATORS, SYNTAX, SEMANTICS.

(U) An Environment for Visualization, Reliability, &  
Knowledge Acquisition in Equational Programming.

IDENTIFIERS: (U) \*Equational programming.

DESCRIPTIVE NOTE: Final rept. 1 Aug 80-31 Aug 93.

APR 93 170P

PERSONAL AUTHORS: Prywes, Noah

CONTRACT NO. AFOSR-90-0335

PROJECT NO. 2304

TASK NO. A7

MONITOR: AFOSR, XC  
TR-94-0255, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We investigated the concept of a visual software environment which facilitates man-machine cooperation during software development. The focus is on 'oracle' operations performed by a human user during the man-machine cooperation. In the environment, graphics and equations are combined to enhance software understanding that is essential in software development. The environment consists of the following components: (1) visual programming: an icon-based graph editor is used for composing an array graph of an equational language program, for interactive syntax analysis, and for consistency checking of the array graph and equations; (2) compilation: an equational language program is statically checked in accordance with its semantics during compilation; (3) equational visual testing: test adequacy criteria are defined for the equational visual testing; the testing process becomes simple and intuitive; oracle operations such as path selection, path examination, finding test input values, monitoring execution, and evaluation are facilitated; (4) verification: equational reasoning is combined with graphical representation of programs; and, (5) knowledge acquisition: expertise in old legacy code in procedural language such as algorithms and methods is transferred to rules of knowledge bases via equations.

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SEATTLE PACIFIC UNIV WA DEPT OF ELECTRICAL ENGINEERING

PENNSYLVANIA UNIV PHILADELPHIA DEPT OF MATERIALS SCIENCE AND ENGINEERING

(U) Error Reduction in Images with the Use of Additional Information.

(U) Flow Behavior of the L12 (Al,Fe)3 Ti-Based Alloys in High Temperature Ordered Intermetallic Alloys-V.

DESCRIPTIVE NOTE: Final rept. 1 May 92-31 Aug 93.

93 7P

JAN 94 84P

PERSONAL AUTHORS: Wu, Z. L.; Pope, D. P.; Vitek, V.

PERSONAL AUTHORS: Matson, Charles L.

CONTRACT NO. F49620-92-J-0228

PROJECT NO. 2304

PROJECT NO. 2306

TASK NO. BS

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0256, AFOSR

MONITOR: AFOSR, XC  
TR-94-0180, AFOSR

UNCLASSIFIED REPORT

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ABSTRACT: (U) The use of additional information to achieve error reduction in images is discussed in this report. Theoretical results are derived for images corrupted with Fourier domain wide-sense stationary noise. Three types of additional information are explored: support, positivity, and high-quality prior image data. The basic mechanism for reducing noise in images with these types of additional information is shown to be enforced correlations in the Fourier data. The amount of noise reduction achieved is shown to be a function of the relative correlation of the noises and the enforced correlations. For significant noise reduction to be achieved, the noises must be significantly uncorrelated relative to the enforced correlations and the sizes of the noise variances must also be significantly uncorrelated. These results are applied to computer-simulated and field data from telescopes with adaptive optics. Support, Positivity, Deconvolution, Convex projections.

DESCRIPTORS: (U) \*ADAPTIVE OPTICS, \*IMAGES, \*NOISE REDUCTION, COMPUTERS, CORRELATION, ERRORS, NOISE, QUALITY, STATIONARY, TELESCOPES, COMPUTERIZED SIMULATION.

IDENTIFIERS: (U) PE61102F, WUAFOSR2304BS.

AD-A278 636

UNCLASSIFIED

Availability: Pub. in Mat. Res. Soc. Symp. Proc., v288 p447-452, 1993. Available to DTIC users only. No copies furnished by NTIS.

ABSTRACT: (U) The compressive flow behavior of single crystalline L12Al67Fe8Ti25 was investigated as a function of temperature and orientation at temperatures from 77K to about 1250K, using specimens with compressive axes orientated near (001), (131), (011), (122) and (111). The operating slip systems seen in these specimens after 0.4% plastic deformation are predominantly of the octahedral type at all temperatures, even in near-(122) and (111) specimens in which the Schmid factors for the primary cube slip system are larger than that for the primary octahedral slip system. The yield stress increases rapidly with decreasing temperature at low temperatures, while it decreases gradually from room temperature to higher temperatures.

DESCRIPTORS: (U) \*BEHAVIOR, \*FLOW, \*SINGLE CRYSTALS, \*TITANIUM, AXES, DEFORMATION, PLASTIC DEFORMATION, PLASTICS, REDUCTION, ROOM TEMPERATURE, YIELD, REPRINTS, ALUMINIDES, ALUMINUM, IRON, COMPRESSIBLE FLOW, STRESSES, SHEAR STRESSES, ALLOYS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2306AS, L12, Slip systems, Schmid factors, Cube slip

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## DTIC REPORT BIBLIOGRAPHY

SEARCH CONTROL NO. T4P42J

AD-A278 598 12/9

AD-A278 597 20/1 20/14 20/4

COLUMBIA UNIV NEW YORK DEPT OF COMPUTER SCIENCE

RICE UNIV HOUSTON TX

(U) Can We Break Intractability Using Randomization or the Average Case Setting?

(U) Computational Mathematics Laboratory for Multiscale Analysis.

DESCRIPTIVE NOTE: Final rept. 1 Sep 91-30 Sep 93,

DESCRIPTIVE NOTE: Final technical rept. 1 Aug 90-30 Sep 93,

SEP 93 30P

FEB 94 29P

PERSONAL AUTHORS: Traub, Joseph F.

PERSONAL AUTHORS: Wells, Raymond, Jr

CONTRACT NO. AFOSR-91-0347

CONTRACT NO. AFOSR-90-0334

PROJECT NO. 2304

MONITOR: AFOSR, XC

TR-94-0249, AFOSR

TASK NO. A2

MONITOR: AFOSR, XC

TR-94-0245, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

ABSTRACT: (U) The following papers cover results of the researchers and make up the final report: (1) A Surprising and Important New Result, by J F Traub, Feb 25, 1994, (2) Recent Progress In Information-Based Complexity, by J F Traub and H Wozniakowski, Invited Paper, Bulletin European Assoc for Theoretical Computer Science, Oct 1993, Number 51, pages 141-154 and (3) Breaking Intractability, by J F Traub and H Wozniakowski, published as cover story of Scientific American, Jan 1994.

DESCRIPTORS: (U) \*PROBLEM SOLVING, \*MONTE CARLO METHOD, \*COMPUTATIONS, PSEUDO RANDOM SYSTEMS.

IDENTIFIERS: (U) Intractability, WUAFOSR2304A2

ABSTRACT: (U) The research done by the Computational Mathematics Laboratory (CML) at Rice University with the support of ARPA and AFOSR Grant. The principal research activity was: (1) Fundamental Wavelet Research, (2) Applications of Wavelets to Partial Differential Equations, (3) Applications of Wavelets to Digital Signal Processing.

DESCRIPTORS: (U) \*PARTIAL DIFFERENTIAL EQUATIONS, \*SIGNAL PROCESSING, \*VISCOUS FLOW, \*ACOUSTIC SCATTERING, MATHEMATICS LABORATORIES, APPLIED MATHEMATICS, BOUNDARY VALUE PROBLEMS, SOLUTIONS(GENERAL), FILTER ANALYSIS, OPERATORS(MATHEMATICS), WAVE PROPAGATION, TIME DEPENDENCE.

IDENTIFIERS: (U) \*Wavelets, M Band wavelets, Filter banks, Dirichlet problems.

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BOSTON UNIV MA DEPT OF ELECTRICAL COMPUTER AND SYSTEMS  
ENGINEERING

INVERSION, \*ATMOSPHERIC SOUNDING, ALGORITHMS, ARTIFICIAL  
SATELLITES, INVERSION, MICROWAVES, PROFILES, RADIANCE,  
SOUNDING.

(U) Application of Differential Inversion to DMSP  
Microwave Sounder Data.

IDENTIFIERS: (U) PEB1102F, Differential inversion.

DESCRIPTIVE NOTE: Annual rept. 1 Aug 92-31 Jul 93,

JUL 93 84P

PERSONAL AUTHORS: Hohlfeld, Robert G.

CONTRACT NO. F49620-92-J-0444

PROJECT NO. 2310

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0201, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Differential Inversion (DI) is a novel approach to the solution of the atmospheric temperature sounding problem which was developed by Dr J.I.F. King of the Air Force's Phillips Laboratory. Before the present research, DI has been applied only to infrared radiance data sets, such as from TOVS/HIRS. In this report I describe the progress made in the first year of a research program to apply DI to microwave radiance data from the SSM/T sounder on the DMSP satellites. The ultimate objectives of this research are to establish effective DI sounding algorithms for the microwave spectral region and to extend DI in directions which increase its utility as a practical sounding algorithm. DI has many attractive features in this application, including its close coupling to the physical formulation of the temperature sounding problem, its freedom from the necessity of using an a priori temperature profile, and its high level of computational efficiency. At present, we have understood the practical difficulties characteristic of temperature sounding in the microwave spectral region (as these apply to DI), and have produced software yielding temperature profiles of a convincing meteorological character.

DESCRIPTORS: (U) \*ATMOSPHERIC TEMPERATURE, \*TEMPERATURE

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PENNSYLVANIA UNIV PHILADELPHIA DEPT OF MATERIALS SCIENCE  
AND ENGINEERING

and has a very destructive impact on ductility.

(U) Microstructures in L12 Titanium Trialuminides  
Containing Iron,

93 7P

DESCRIPTORS: (U) \*ALLOYS, \*MICROSTRUCTURE, \*TITANIUM,  
ALUMINIDE, \*IRON, CRACKS, DUCTILITY, HARDENING, IMPACT,  
INTERFACES, PHASE, PLATES, POROSITY, SINGLE CRYSTALS,  
SITES, TEMPERATURE, REPRINTS, LOW TEMPERATURE, ALUMINUM,  
BRITTLENESS.

PERSONAL AUTHORS: Wu, Z. L.; Pope, D. P.; Vitek, V.

IDENTIFIERS: (U) L1 sub 2, PEB1102F, WUAFOSR2306AS.

CONTRACT NO. F49620-92-J-0019

PROJECT NO. 2306

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0182, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Mat. Res. Soc. Symp. Proc., V288  
p367-372, 1993. Available to DTIC users only. No copies  
furnished by NTIS.

ABSTRACT: (U) The microstructures of the L12 titanium  
trialuminides at low temperatures were studied using a  
number of single crystals with various Al-Ti-Fe  
compositions, all of which lie in the nominal single  
phase L12 field at 1200 deg C. Five different second  
phases were found to be in equilibrium with the L12  
matrix, namely, (Al,Ti)3Fe, Al3Ti, Al2FeTi, Ti2NaI and  
Al2Ti+Fe. Small volume fractions of the first two phases  
are often seen in compounds containing relatively low Ti  
contents. The Al2FeTi, a so-called T phase, was observed  
at relatively high Fe contents. The Ti2NaI does not seem  
to be sensitive to the Al-Ti-Fe composition, it exists to  
some extent in all the alloys used in this study. Ti2NaI  
and the interface with the L12 matrix are found to be  
brittle and provide the sites for crack initiation. The  
Al2Ti+Fe phase has been observed in many compounds  
containing high Ti contents (>25 at.%), and has a large  
hardening effect. Like binary Al2Ti, the phase possesses  
a tetragonal structure of the Ga2Hf-type, and forms  
plates on the cube planes of the L12 matrix. The  
crystallographic relation between the Al2Ti and the L12  
matrix was determined to be (100)p//((100)m and (010)p//  
(100)m. Porosity is also commonly seen in these alloys.

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COLORADO STATE UNIV FORT COLLINS DEPT OF ELECTRICAL  
ENGINEERING

DESCRIPTORS: (U) \*CLOUDS, \*CLOUD PHYSICS, \*RADAR  
SIGNATURES, \*STORMS, ALABAMA, CELLS, FREEZING, TRAINING  
AIRCRAFT, CONVECTION(ATMOSPHERIC), ELECTRIC FIELDS, RADAR,  
IMAGES, LIFE CYCLES, LIGHTNING, MOTION, PARTICLES, WIND,  
RAIN, SOUTH DAKOTA, SYNTHESIS, WIND.

(U) Multiparameter Radar and Aircraft Based Studies of  
Microphysical, Kinematic and Electrical Structure of  
Convective Clouds during CAPE.

IDENTIFIERS: (U) PEG1102F, WJAFDSR2310CS, T-28 Aircraft.

DESCRIPTIVE NOTE: Final rept. 15 Jan 91-14 Jan 94,

MAR 94 37P

PERSONAL AUTHORS: Bringl, V. N.

CONTRACT NO. AFOSR-91-0141

PROJECT NO. 2310

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0248, AFOSR

# UNCLASSIFIED REPORT

ABSTRACT: (U) Two storms from the 9 August, 1991 Cape case were analyzed in-depth focusing on multiparameter radar signature evolution over 80 min. In coordination with 24 aircraft penetrations which provided particle image and electric field data together with vertical air motion, cloud water and other state parameters. A total of five discrete 'cells' were identified in the two storms and their life cycle fully documented. Collaboration with South Dakota School of Mines and University of Alabama at Huntsville has resulted in a full integration of aircraft image and field mill data (from SDSM&T T-28 aircraft) with vertical air motion from dual-Doppler wind synthesis (UAH). The cellular evolution starts with a warm rain phase where updrafts and a very low concentration of large drops dominate the cloud. As the supercooled drops rise in the updraft they freeze and acquire a water-coat possibly by collisions with other liquid drops. The multi-parameter radar signatures clearly identify this mixed-phase zone. The cloud thereafter gets electrified which may intensify to produce lightning depending on cloud vertical growth, and generation of updraft/ downdrafts. Radar, Electric field, Microphysics.

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12/9

UNIVERSITY OF SOUTHERN CALIFORNIA LOS ANGELES INST FOR  
ROBOTICS AND INTELLIGENT SYSTEMS

(U) Research in Image Understanding.

DESCRIPTIVE NOTE: Final technical rept. 1 Sep 90-31 Sep  
94.

JAN 94 24P

PERSONAL AUTHORS: Nevatia, Ramakant

REPORT NO. IRIS-92-320

CONTRACT NO. F49620-90-C-0078

PROJECT NO. 7515

TASK NO. 00

MONITOR: AFOSR, XC  
TR-94-0248, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We undertook a broad program for research into image understanding techniques suited for a variety of applications. We divided our tasks into three major categories. However, we wish to emphasize that the different tasks are highly interrelated and share many common techniques. The major task areas over the course of this contract were three-dimensional vision including descriptions from range data, shape inference from images, and object recognition; motion analysis and parallel processing. This report discusses the status of the various individual research projects funded by this contract. Computer vision, image analysis, three-dimensional descriptions, motion estimation, mobile robot,

DESCRIPTORS: (U) \*COMPUTER VISION, \*IMAGE PROCESSING, COMPUTERS, CONTRACTS, IMAGES, MOBILE, MOTION, PARALLEL PROCESSING, RECOGNITION, ROBOTS, SHAPE, THREE DIMENSIONAL.

IDENTIFIERS: (U) PE61102F, WUAFOSR751500, \*Image understanding, Object recognition, \*Visual processing

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5/8

JOHNS HOPKINS UNIV BALTIMORE MD DEPT OF PSYCHOLOGY  
(U) Stochastic Models of Attention and Search.

DESCRIPTIVE NOTE: Annual rept. 1 Mar 93-28 Feb 94,

FEB 94 20P

PERSONAL AUTHORS: Yantis, Steven

CONTRACT NO. F49620-92-J-0186

PROJECT NO. 2313

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0247, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Six lines of experimentation have been continued. In the first set of experiments, the PI has tested and rejected a two-process model of visual attention allocation. He has proposed an alternative perceptual sampling model and performed stochastic simulations of the model to show that it can account for certain aspects of human performance in cued visual search tasks. In the second set of experiments, the PI has found evidence that observers perceive occluded objects across time, a finding that complements an analogous ability to perceptually complete partially occluded objects across space. Several lines of experimentation have been carried out using a bistable apparent motion display (the Ternus display) as a tool to explore the assignment of object identity over time. For example, the PI has found evidence that a common mechanism may underlie the perception of bistable apparent motion and the capture of visual attention in certain visual search tasks, and he has discovered that perceptual grouping by proximity can precede the assignment of motion correspondences in bistable apparent motion. In the fifth project, the PI has shown that visual salience is not sufficient to produce attentional capture; a deliberate state of attentional readiness is required to guide attention according to salient stimulus attributes.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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DESCRIPTORS: (U) \*ATTENTION, \*MODELS, \*PERFORMANCE(HUMAN)  
 , \*VISUAL PERCEPTION, \*STOCHASTIC PROCESSES, ALLOCATIONS,  
 HUMANS, IDENTITIES, MOTION, OBSERVERS, SAMPLING,  
 SIMULATION, TIME, TOOLS, SEARCHING.

CALIFORNIA UNIV LOS ANGELES

(U) Ab initio H<sub>2</sub> Desorption Pathways for H/Si(100): The  
 Role of SiH<sub>2</sub>(a),

IDENTIFIERS: (U) PE81102F, WUAFOSR23138S.

93 16P

PERSONAL AUTHORS: Wu, Christine J.; Ionova, Irina V.;  
 Carter, Emily A.

CONTRACT NO. F49620-93-1-0145

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
 TR-94-0177, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Surface Science, v295 p64-78, 1993.  
 Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) We present ab initio calculations  
 examining two previously proposed mechanisms for H<sub>2</sub>  
 desorption from the Si(100)-2 x 1 monohydride phase: (i)  
 the prepairing mechanism, where H<sub>2</sub> desorbs directly in a  
 one-step process via two hydrogen atoms paired on one  
 silicon dimer and (ii) a stepwise mechanism in which H<sub>2</sub>  
 desorbs from a dihydride intermediate formed via  
 isomerization of the monohydride. Both pathways are  
 predicted to be 66 kcal/mol endothermic. A detailed  
 search of the transition state region rules out the  
 direct one-step mechanism, as only one saddle point was  
 found and a search of the reaction path showed that it  
 evolves from the dihydride intermediate rather than the  
 monohydride. This saddle point for the second pathway  
 corresponds to a desorption activation barrier of 94 kcal/  
 mol, which is much higher than those measured by thermal  
 desorption experiments (45-66 kcal/mol). Other prepairing  
 desorption pathways involving H<sub>2</sub> desorption from two  
 neighboring hydrogen atoms on adjacent dimers are argued  
 to be inconsistent with the observed first-order kinetics.  
 Thus, no previously proposed mechanism appears consistent  
 with both the observed barrier height and reaction order.  
 We propose an alternative mechanism involving H atom  
 diffusion prior to H<sub>2</sub> desorption.

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AD-A278 533 9/5 20/6 17/5 20/14

STANFORD UNIV CA

DESCRIPTORS: (U) \*DESORPTION, \*HYDRIDES, \*SILICON COMPOUNDS, \*HYDROGEN, COMPUTATIONS, WATER, KINETICS, REPRINTS.

(U) New Light Sources and Concepts for Electro-Optic Sampling.

IDENTIFIERS: (U) PEB1102F, WUAFOSR2303FS.

DESCRIPTIVE NOTE: Final technical rept. 1 Jan 92-31 Dec 93,

MAR 94 101P

PERSONAL AUTHORS: Bloom, David M.

CONTRACT NO. F49620-92-J-0099

PROJECT NO. 2301

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0236, AFOSR

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

ABSTRACT: (U) Research to improve electro-optic sampling led to the development of several high performance optical phase modulators. These phase modulators serve as a 'time-lens' in a series of experiments on temporal optical systems. These systems are used to generate, manipulate and measure optical pulses. Significant results have been shown in three areas. First is active optical pulse compression, where 55 ps 1.064 um pulses were compressed to 1.7 ps. Notably, laser timing jitter is reduced in this process. Second, temporal imaging demonstrated the ability to magnify the time axis of an optical pulse, stretching a short pulse into a longer replica. This tool has application in pulse shape measurement and optical signal processing. Finally, a new method of optical pulse shape measurement was demonstrated with 3 ps time resolution, excellent power sensitivity and relative system simplicity. These experiments have opened up the field of temporal optics. Electro-optic sampling.

DESCRIPTORS: (U) \*PULSE COMPRESSION, \*OPTICAL IMAGES, \*OPTICAL LENSES, \*ELECTROOPTICS, \*LIGHT SOURCES,

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COMPRESSION, JITTER, LASERS, MODULATORS, OPTICS, POWER, PULSES, REPLICAS, RESOLUTION, SAMPLING, SENSITIVITY, SHAPE, SHORT PULSES, SIGNAL PROCESSING, SIGNALS, PHASE MODULATION, FOURIER TRANSFORMATION, OPTICAL WAVEGUIDES, PATENTS, INVENTIONS, RESONATORS, THESES, MICROWAVES, QUALITATIVE ANALYSIS.

FLORIDA UNIV GAINESVILLE

(U) Multifunctional Gel-Silica Optics.

DESCRIPTIVE NOTE: Final rept. 1 Mar 90-31 Dec 93,

JAN 94 77P

IDENTIFIERS: (U) WUAFOSR2301AS.

PERSONAL AUTHORS: Hench, Larry L.

CONTRACT NO. AFOSR-91-O193

MONITOR: AFOSR, XC  
TR-94-O157, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) High purity gel-silica matrices are produced using alkoxide sol-gel processing to form net-shape optical components with interconnected porosity. The porous optical matrices are impregnated with optically active polymers to produce multifunctional optical composites such as tunable dye lasers, scintillators, and photopolymerized 3-D gratings. Thus, the feasibility has been established for a new generation of multi-functional optical materials for sensors, detectors, waveguides, transpiration cooling, lasers, scintillators, multiplexers, etc. Gel-silica, Lasers, polymers, Micro optics, Diffractive optics, Waveguides, Porous matrices.

DESCRIPTORS: (U) \*SILICA GELS, \*OPTICAL MATERIALS, \*SPECTROSCOPY, \*LASER APPLICATIONS, COOLING, DETECTORS, DYE LASERS, GELS, LASERS, TUNABLE LASERS, OPTICS, POLYMERS, POROSITY, DIFFRACTION, PROCESSING, PURITY, SHAPE, SWEAT COOLING, TRANSPIRATION, WAVEGUIDES, SCINTILLATION, MULTIPLEXING, OPTICAL WAVEGUIDES, MONOMERS, DOPING, OPTICAL DETECTORS, OPTICAL GLASS.

IDENTIFIERS: (U) Sol-gels, Laser optics.

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AD-A278 530 6/4

AD-A278 529 8/11 8/7

NEW YORK UNIV NY DEPT OF PSYCHOLOGY

CALIFORNIA INST OF TECH PASADENA

(U) Visual Motion Perception and Visual Information Processing.

(U) Mapping Crust and Upper Mantle Structure Beneath Southern Eurasia.

DESCRIPTIVE NOTE: Annual rept. 1 Feb 92-31 Dec 93,

DESCRIPTIVE NOTE: Annual rept. 1 Sep 92-31 Aug 93,

DEC 93 22P

AUG 93 46P

PERSONAL AUTHORS: Sperling, George

PERSONAL AUTHORS: Helmberger, Donald V.

CONTRACT NO. AFOSR-91-0178

CONTRACT NO. F49620-92-J-0470

PROJECT NO. 2313

PROJECT NO. 2309

TASK NO. AS

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0205, AFOSR

MONITOR: AFOSR, XC  
TR-94-0202, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) This project concerned the discovery and description of basic mechanisms of human visual motion and texture perception. Motion and texture are critical inputs to visual perception. Basic mechanisms of motion are of particular interest because they are perhaps the primary substrate for perceptual recovery of 3D depth structures and orientation in space. They are critical for detecting new objects and events in the environment, as well as playing an important role in 2D perception. Motion and texture are considered together here because the problem of discriminating velocity in a one-dimensional motion stimulus is formally equivalent to the problem of discriminating orientation in a texture stimulus: the t dimension of the motion stimulus becomes the y dimension of the texture stimulus.

DESCRIPTORS: (U) \*MOTION, \*VISUAL PERCEPTION, DEPTH, ENVIRONMENTS, HUMANS, INPUT, ONE DIMENSIONAL, PERCEPTION, RECOVERY, STRUCTURES, SUBSTRATES, TEXTURE, VELOCITY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2313AS.

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ABSTRACT: (U) In this study of lateral variations in compressional velocity in the uppermost mantle underneath the Tibetan plateau, 353 Pn travel times were collected for 44 Tibetan earthquakes at 46 seismic stations. The inverse method and procedures in this study differ from previous Pn tomography studies in that corrections were applied to the biases caused by (1) event mislocation by ISC, (2) mantle velocity gradient, and (3) large-scale variations in crustal thicknesses. Main results to date are: (1) the average P velocity value for the uppermost mantle in Tibet is  $7.93 \pm 0.17$  km/s; (2) the average P velocity gradient in the upper 150 km of the mantle is  $1 \times 10^{-3}$  s/km; (3) the 2D P velocity image of the region includes a low velocity zone in the north central Tibet, and two high velocity zones in the western and eastern flanks of Tibet; and (4) in much of the area inside Tibet, the crustal thickness exceeds 70 km. Another important finding of this study is that event relocation (see the bias 1) plays a very important role in reliably retrieving the detailed lateral variations in 2D P velocity image. Corrections to biases 2 and 3, seem to have a greater effect on the average of the velocity image, causing over-estimations.

DESCRIPTORS: (U) \*EARTHQUAKES, \*EARTH CRUST, \*EARTH MANTLE, \*SEISMIC VELOCITY, \*SEISMIC WAVES, GRADIENTS,

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HIGH VELOCITY, EURASIA, IMAGES, LOW VELOCITY, PLATEAUS,  
PRIMARY WAVES(SEISMIC WAVES), THICKNESS, TOMOGRAPHY,  
TRAVEL TIME, TECTONICS, SEISMOLOGICAL STATIONS, VELOCITY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2309AS, Tibet, Tibetan  
plateau.

AD-A278 528 20/6 9/1 20/12 7/2

SPIRE CORP BEDFORD MA

(U) Visible and Infrared (1.54 micrometers) LED Based on  
ER-Doped Porous Si.

DESCRIPTIVE NOTE: Final rept. 1 Jul-31 Dec 93,

FEB 94 35P

PERSONAL AUTHORS: Namavar, Fereydoon

REPORT NO. FR-60291

CONTRACT NO. F49620-93-C-0040

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-O199, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Phase I demonstrated strong room-temperature 1.54 micrometers luminescence from visible light-emitting porous Si doped with erbium. Er was implanted with a dose of 10(exp 15)/sq cm at 190 keV into porous Si, bulk Si, GeSi, quartz, and sapphire. The highest emission intensity was observed for porous Si samples which were annealed at 650 deg C and had a peak concentration of 1.5 x 10(exp 20) Er/sq cm. However, no IR emission was observed from Er in bulk Si, GeSi, quartz, and sapphire. Our results show that the high PL efficiency in Er-implanted porous Si originates from Er confined in < 5nm-diameter Si nanostructures. In these samples, only an insignificant decrease in PL intensity was observed from 77 to 300K. In addition, Phase I work clearly indicates that photoluminescence (PL) intensity is almost comparable to In(0.53)Ga(0.47)As material, which is used for commercial infrared (IR) light-emitting diodes (LEDs). These results suggest that Er:porous-Si electroluminescent devices with practical quantum efficiency at 300K are feasible. Porous Si, Visible light emission, Er Implantation, Infrared emission, Nanostructures photoluminescence, Electroluminescence, Room temperature, Fiber optics.

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DESCRIPTORS: (U) \*ERBIUM, \*LIGHT EMITTING DIODES, \*SILICON, \*DOPING, ELECTROLUMINESCENCE, EMISSION, FIBER OPTICS, FIBERS, IMPLANTATION, INTENSITY, MATERIALS, OPTICS, PHASE, PHOTOLUMINESCENCE, QUANTUM EFFICIENCY, QUARTZ, ROOM TEMPERATURE, SAPPHIRE, TEMPERATURE, INFRARED EQUIPMENT, POROUS MATERIALS, ANNEALING, GERMANIUM.

MARYLAND UNIV COLLEGE PARK DEPT OF ELECTRICAL ENGINEERING

(U) Theoretical and Experimental Studies of Auditory Processing.

DESCRIPTIVE NOTE: Annual rept. 1 Sep 92-31 Aug 93,

IDENTIFIERS: (U) WUAFOSR3005SS, \*Visible.

MAR 94 4P

PERSONAL AUTHORS: Shamma, Shihab; Krishnaprasad, P. S.

CONTRACT NO. F49620-92-J-0500

PROJECT NO. 2313

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0244, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Over the last year, work has progressed in the three basic areas that are emphasized in this proposal: (1) peripheral auditory implementations; (2) Auditory cortical processing; (3) Theoretical analysis of neural network architectures. In the first topic, we have completed a detailed analysis and implementation of the early auditory model originally formulated in the previous grant period. Specifically, we have determined the underlying mechanisms that give rise to noise robustness and self-normalization in the early auditory spectra. A patented VLSI implementation of the model has been accomplished. In the second area of research, we have completed a survey of response properties in the anterior auditory field, especially with regard to the cells' responses to FM and single tone stimuli. Finally, in the third focus area, we have developed new recursive algorithms (mimicking recursive neural network architectures) for building systematically approximate basis function representations. The new algorithms known as orthogonal matching pursuit algorithms are applicable to a wide class of problems, ranging from fitting radial basis function approximations to wavelet-bases models for transfer functions of linear systems.

DESCRIPTORS: (U) \*MODELS, \*AUDITORY PERCEPTION,

AD-A278 528

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ALGORITHMS, ARCHITECTURE, GRANTS, LINEAR SYSTEMS, MATCHING, NETWORKS, NEURAL NETS, NOISE, RESPONSE, SPECTRA, STIMULI, SURVEYS, TRANSFER FUNCTIONS, VERY LARGE SCALE INTEGRATION.

IDENTIFIERS: (U) WUAFOSR2313AS, PEB1102F.

AD-A278 489 20/4

PRINCETON UNIV NJ DEPT OF MECHANICAL AND AEROSPACE ENGINEERING

(U) The Structure of High Reynolds Number Turbulent Boundary Layers.

DESCRIPTIVE NOTE: Final rept. 1 Apr 90-31 Mar 93,

OCT 93 23P

PERSONAL AUTHORS: Smits, Alexander J.

CONTRACT NO. AFOSR-90-0217

PROJECT NO. 2307

TASK NO. A2

MONITOR: AFOSR, XC  
TR-94-0226, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report is the Final Technical Report for AFOSR URI Grant 90-0217. The effort described in this report is the Princeton part of a joint effort among Penn State University (Professor Jim Brasseur), Princeton University (Professor Lex Smits) and Yale University (Professor K. Sreenivasan) to try to improve our understanding of the turbulent boundary layer at high Reynolds numbers. Turbulent boundary layers, Reynolds number.

DESCRIPTORS: (U) \*REYNOLDS NUMBER, \*TURBULENT BOUNDARY LAYER, BOUNDARY LAYER, GRANTS, FLOW VISUALIZATION, BOUNDARY LAYER FLOW.

IDENTIFIERS: (U) PEB1102F, High Reynolds number.

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AD-A278 480 20/2 20/5 7/2

ARIZONA UNIV TUCSON COLL OF MEDICINE

SCIENTIFIC MATERIALS CORP BOZEMAN MT

(U) Information Processing in Medical Imaging Meeting (IPMI).

(U) Materials for Spectral Hole Burning Research. Phase 1.

DESCRIPTIVE NOTE: Final rept. 1 Jun-30 Sep 93,

DESCRIPTIVE NOTE: Final rept. 1 Jun 93-28 Feb 94,

SEP 93 26P

MAR 94 58P

PERSONAL AUTHORS: Barrett, Harrison H.

PERSONAL AUTHORS: Hutcheson, R. L.; Cone, R.

CONTRACT NO. F49620-93-1-0352

REPORT NO. SM-94-0006

PROJECT NO. 2305

CONTRACT NO. F49620-93-C-0023

TASK NO. DS

PROJECT NO. 3005

MONITOR: AFOSR, XC  
TR-94-0193, AFOSR

MONITOR: AFOSR, XC  
TR-94-0233, AFOSR

UNCLASSIFIED REPORT

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ABSTRACT: (U) Welcome to the thirteenth IPMI. As attendees here in beautiful northern Arizona, you are part of a tradition extending back to the early days of digital imaging. This conference holds a special place in the hearts of many longtime IPMI-goers. No other conference in our field can provide the spirited interactions and the stimulation that occur regularly at this one. To the IPMI veterans, we say welcome back, and thanks for continuing to make our conference the unique event it is. To first-time attendees, we extend a special welcome and an invitation to join the fray, to contribute your insights and criticisms of the ideas offered here. Let's all join in the give and take that lend vitality and excitement to our endeavors.

DESCRIPTORS: (U) \*IMAGES, \*X RAYS, \*RADIOLOGY, LASERS, OPTICAL DATA, CLINICAL MEDICINE, REPORTS, TOMOGRAPHY.

IDENTIFIERS: (U) Medical Imaging.

ABSTRACT: (U) Work on the crystal growth and evaluation of crystals for PSHB application has shown good high quality crystals of yttrium silicate, calcium tungstate, and yttria are feasible. Dopants discussed are praseodymium, samarium and europium. The work shows Sm: two plus is not feasible in calcium tungstate. A sample of Eu:yttrium silicate shows one half homogeneous linewidth of previous Eu:yttrium silicate. Holeburning crystal growth, Yttrium silicate, Calcium tungstate, Yttria.

DESCRIPTORS: (U) \*CRYSTAL GROWTH, \*MATERIALS, CALCIUM, EUROPIUM, PRASEODYMIUM, SAMARIUM, SILICATES, TUNGSTATES, YTTRIUM, DOPING.

IDENTIFIERS: (U) WUAFOSR3005SS, \*Holeburning, Yttria, \*Spectral, Homogeneous linewidth, PSHB(Persistent Spectral Hole Burning)

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CERAMATEC INC SALT LAKE CITY UT

(U) New Mechanism for Toughening Ceramic Materials.

DESCRIPTIVE NOTE: Final rept. 15 Mar 89-15 Jul 93,

FEB 94 264P

PERSONAL AUTHORS: Cutler, Raymond A.; Virkar, Anil V.;  
Cross, L. E.; Lange, Fred F.

CONTRACT NO. F49620-89-C-0054, DARPA Order-5994

PROJECT NO. 9464

TASK NO. 00

MONITOR: AFOSR, XC  
TR-94-0152, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) Ferroelastic toughening was identified as a viable mechanism for toughening ceramics. Domain structure and domain switching was identified by x-ray diffraction, transmission optical microscopy, and transmission electron microscopy in zirconia, lead zirconate titanate and gadolinium molybdate. Switching in compression was observed at stresses greater than 800 MPa and at 400 MPa in tension for polycrystalline t'-zirconia. Domain switching contributes to toughness, as evidenced by data for monoclinic zirconia, t'-zirconia, PZT and GMD. The magnitude of toughening varied between 0.6 MPa.m<sup>1/2</sup> for GMD to 2-6 MPa.m<sup>1/2</sup> for zirconia. Polycrystalline monoclinic and t'-zirconias, which showed no transformation toughening, had similar toughness values as Y-TZP which exhibits transformation. Coarse-grained monoclinic and tetragonal (t') zirconia samples could be cooled to room temperature for mechanical property evaluation since fine domain size, not grain size, controlled transformation for t'-zirconia and minimized stress for m-ZrO<sub>2</sub>. LnAlO<sub>3</sub>, LnNbO<sub>4</sub>, and LnCrO<sub>3</sub> were among the materials identified as high temperature ferroelastics. Ferroelastic toughening, Twinning, Domain switching.

**DESCRIPTORS:** (U) \*MECHANICAL PROPERTIES, \*CERAMIC MATERIALS, COMPRESSION, DIFFRACTION, ELECTRON MICROSCOPY,

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FINES, GADOLINIUM, GRAIN SIZE, HIGH TEMPERATURE, MICROSCOPY, POLYCRYSTALLINE, ROOM TEMPERATURE, STRESSES, STRUCTURES, SWITCHING, TEMPERATURE, TENSION, TITANATES, TOUGHNESS, TRANSFORMATIONS, VALUE, X RAY DIFFRACTION, X RAYS, ZIRCONATES.

IDENTIFIERS: (U) WUAFOSR94640001, \*Ferroelastic toughening

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WILLIAMS COLL WILLIAMSTOWN MA

HIFS(Hyperfine Induced Frequency Shifts), \*Stimulated emission.

(U) Collision and Motional Averaging Effects in Cryogenic Atomic Hydrogen Masers.

DESCRIPTIVE NOTE: Final technical rept. 1 Aug 91-31 Sep 93,

SEP 93 11P

PERSONAL AUTHORS: Crampton, Stuart B.; McAllaster, Donald R.

REPORT NO. WMC-AFOSR-002

CONTRACT NO. AFOSR-91-0312

PROJECT NO. 2301

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0194, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Substantial progress has been made toward optimizing the performance of the neon surface cryogenic hydrogen maser, preparatory to measuring the hyperfine induced frequency shifts (HIFS) in collisions between hydrogen atoms at low temperatures. Self-excited maser oscillation has been achieved at temperatures from 8.5 to 11.5 K. There is little surface relaxation at the higher temperatures. There is substantial collision broadening at the highest achievable atom densities, which is useful for spin exchange cavity tuning and which indicates the presence of measurable HIFS. We have also made significant progress in understanding the Doppler effect in motional averaging systems such as the cryogenic maser.

DESCRIPTORS: (U) \*COLLISIONS, \*CRYOGENICS, \*FREQUENCY SHIFT, \*HYDROGEN, \*MASERS, \*MOTION, \*ATOMIC STRUCTURE, \*MICROWAVE AMPLIFIERS, ATOMS, CAVITIES, COLLISION BROADENING, DENSITY, DOPPLER EFFECT, EXCHANGE, NEON, OSCILLATION, RELAXATION, SURFACES, TEMPERATURE, TUNING, LOW TEMPERATURE, SPIN STATES, HYPERFINE STRUCTURE.

IDENTIFIERS: (U) WUAFOSR2301DS, Averaging effects,

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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MASSACHUSETTS INST OF TECH CAMBRIDGE EARTH RESOURCES LAB

(U) Basic Research in Nuclear Test Monitoring: Explosions in Non-Spherical Cavities: Investigations of Enhanced Backscattering.

DESCRIPTIVE NOTE: Annual technical rept. 1 Aug 92-31 Jul 93,

JAN 94 103P

PERSONAL AUTHORS: Mandal, Batakrishna; Schultz, Craig A.; Dong, Wenjie; Toksoez, M. N.; Rodi, William

CONTRACT NO. F49620-92-J-0413

PROJECT NO. 2309

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0200, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We report on two studies. The first is a theoretical study of the seismic radiation from explosions detonated in finite cylindrical tunnels embedded in a homogeneous, isotropic, elastic medium. We developed a frequency domain boundary element/discrete wavenumber algorithm to model the seismic wavefields from such sources, and applied the algorithm to study two specific cases of explosion sources-nuclear and non-nuclear. Our calculations show different source radiation patterns between the two types of explosions, especially when the explosion is located off-center in the tunnel in which case the non-nuclear explosion radiation displays strong directivity effects. Both types of explosions radiate significant shear wave energy outside the cavity. The second study is on enhanced seismic backscattering from rough interfaces. We experimentally and numerically investigate the scattering of an acoustic P wave incident on a highly irregular, random acoustic-elastic interface to determine whether enhanced backscattering occurs. The experiments involve ultrasonic waves reflected from a glass surface etched to produce a highly irregular 3-D surface. We find that 2-D numerical results predict the 3-D experimental results well at small incident angles.

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Both numerical and experimental results strongly support the presence of enhanced backscattering. Explosion seismology, Non-spherical cavities, Seismic scattering, Enhanced backscattering.

DESCRIPTORS: (U) \*NUCLEAR EXPLOSION TESTING, \*EXPLOSIONS, \*SEISMOLOGY, ACOUSTICS, ALGORITHMS, ANGLES, BACKSCATTERING, CAVITIES, FREQUENCY DOMAIN, SEISMIC WAVES, ELASTIC PROPERTIES, GLASS, INTERFACES, MODELS, NUCLEAR EXPLOSIONS, ACOUSTIC WAVES, RADIATION PATTERNS, SCATTERING, SURFACES, TUNNELS, ULTRASONICS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2309AS.

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OPTICAL POLYMER RESEARCH GAINESVILLE FL

MELTS, METHACRYLATES, MOLECULAR WEIGHT, POLYMERS,  
PROPAGATION, STYRENES, TEST AND EVALUATION, WEIGHT.

(U) Proposal to Produce Novel, Transparent Radiation Hard  
Low Refractive Index.

DESCRIPTIVE NOTE: Final rept. 1 Oct-31 Dec 93,

FEB 94 22P

PERSONAL AUTHORS: Schuman, Paul D.; Harmon, Julie

CONTRACT NO. F49620-93-C-0038

MONITOR: AFOSR, XC  
TR-94-0148, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Low and high molecular weight polymers of heptafluorobutyl methacrylate, HFBM, were prepared for commercial evaluation by Bicon, an optical fiber manufacturer. Polymers were evaluated as low refractive index fiber cladding materials. Test results of Low MW polymer solutions gave excellent results. Higher MW polymers were prepared for cladding by melt co-extrusion. Corning Glass Corp, also expressed an interest in these cladding materials. These results appear to be sufficiently unique that a search has been initiated to determine patentability of the soluble fluorocarbon acrylate, methacrylate and copolymer compositions for cladding use. Our research resulted in identifying a radiation hard, low refractive index polymer, poly(heptafluorobutyl methacrylate), P(HFBM), as the best candidate for a novel cladding material. P(HFBM) has a refractive index of 1.387. When used to clad a styrene core, the theoretical light propagation efficiency is 50% greater than that of styrene a fiber core clad with PMMA, a common commercial cladding material. These polymers will be the only commercial fluorocarbon acrylic cladding polymers available to U.S. manufacturers. Japanese optical fiber manufacturers produce fluorocarbon clad fibers but their polymers are not available to U.S. manufacturers. These polymers can fill an urgent need in the optical fiber market.

DESCRIPTORS: (U) \*RADIATION, \*REFRACTIVE INDEX,  
ACRYLATES, CLADDING, COPOLYMERS, CORES, EFFICIENCY,  
EXTRUSION, FIBERS, GLASS, INDEXES, LIGHT, MATERIALS,

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AD-A278 474 20/4

DENVER UNIV CO DEPT OF CHEMISTRY

ILLINOIS INST OF TECH CHICAGO FLUID DYNAMICS RESEARCH CENTER

(U) Reactions and Spectroscopy of Excited Nitrenes.

(U) Control and Management of Unsteady and Turbulent Flows.

DESCRIPTIVE NOTE: Final rept. 1 May 92-31 Oct 93,

DESCRIPTIVE NOTE: Final rept. Apr 90-Dec 93,

JAN 94 41P

DEC 93 36P

PERSONAL AUTHORS: Coombe, Robert D.

PERSONAL AUTHORS: Nagib, H.; Acharya, M.; Corke, T.; Wark, C.; Williams, D.

CONTRACT NO. F49620-92-J-0270

PROJECT NO. 1601

CONTRACT NO. AFOSR-90-0173

TASK NO. 08

PROJECT NO. 2307

MONITOR: AFOSR, XC  
TR-94-0145, AFOSRMONITOR: AFOSR, XC  
TR-94-0190, AFOSR

## UNCLASSIFIED REPORT

**ABSTRACT:** (U) This report describes the results of an 18 month research program in which reactions and energy transfer processes involving excited  $\text{NCl}(a1\Delta)$  were investigated. The work included three projects. In the first of these, high densities ( $> 10(\text{exp } 15/\text{cu cm})$ ) of  $\text{NCl}(a1\Delta)$  were produced by photodissociation of  $\text{ClN}_3$ , and excited  $\text{I}(5\text{ sup } 2\text{ p } 1/2)$  atoms were generated by a subsequent energy transfer process. The data suggest that a population inversion on the  $\text{I}(5\text{ sup } 2\text{ p } 3/2) - \text{I}(5\text{ sup } 2\text{ p } 3/2)$  transition was achieved, but the inversion density was insufficient to reach laser threshold in the optical cavity employed. In the second project, rate constants for collisional quenching of  $\text{NCl}(a1\Delta)$  by a number of atoms and diatomic molecules were measured. In the third project, the production of  $\text{NCl}(a1\Delta)$  by the  $\text{H} + \text{NC12}$  reaction was investigated in a continuous transverse-flow reactor, at high reagent densities.

**DESCRIPTORS:** (U) \*ENERGY TRANSFER, \*EXCHANGE REACTIONS, ATOMS, CAVITIES, CONSTANTS, DIATOMIC MOLECULES, FLOW, HIGH DENSITY, INVERSION, LASERS, MOLECULES, PHOTODISSOCIATION, POPULATION, PRODUCTION, QUENCHING, RATES, TRANSITIONS, TRANSVERSE, OPTICS, EXCITATION, CHEMICAL LASERS, DIATOMIC MOLECULES.

IDENTIFIERS: (U) PE63218C, WUAFOSR160108, \*Nitrenes

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## UNCLASSIFIED REPORT

**ABSTRACT:** (U) Active input of tuned and detuned two-dimensional and oblique modes in a layer was found to lead to the growth of near-subharmonic modes as well as numerous sum and difference modes, thereby emulating 'natural' transition. Acoustic receptivity of laminar boundary layers with nonlocalized low-amplitude periodic waviness was experimentally investigated and compared favorably to theoretical predictions. Closed loop excitation of axisymmetric and azimuthal modes in a free round jet were used to reveal the character of high Reynolds number transition (i.e., supercritical Hopf bifurcation) and to study mode selection and switching. Suction and blowing were shown to be capable of controlling the asymmetric flow about the forebodies of aircraft and missiles and the experiments indicate that the suction bleed coefficient must increase like the 3.9 power of the velocity to balance the effects of geometric instability at the tip. The effects of yaw on such asymmetries were also documented. A strategy to suppress the dynamic-stall vortex over a range of operating parameters, using controlled leading-edge suction to prevent accumulation of reverse-flowing fluid, was successfully developed from a study of the mechanisms responsible for the evolution of the vortex. The National Diagnostic Facility was completed and several

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SEARCH CONTROL NO. T4P42J

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collaborative experiments are scheduled during 1984. Turbulence, Separated flows, Unsteady flows, Transition, Forebody flows, Pitching airfoils, Jet flows, Control.

DESCRIPTORS: (U) \*UNSTEADY FLOW, \*TURBULENT FLOW, ACCUMULATION, ACOUSTICS, AIRCRAFT, AIRFOILS, AMPLITUDE, AXISYMMETRIC, BALANCE, BOUNDARIES, BOUNDARY LAYER, COEFFICIENTS, CONTROL, DYNAMICS, EDGES, EXCITATION, FLUIDS, INPUT, INSTABILITY, LAYERS, LEADING EDGES, LOOPS, PARAMETERS, POWER, PREDICTIONS, REYNOLDS NUMBER, SELECTION, STRATEGY, SUCTION, SWITCHING, TRANSITIONS, TURBULENCE, TWO DIMENSIONAL, VELOCITY, YAW, JET FLOW.

IDENTIFIERS: (U) PES1102F, WUAFOSR2307BS.

ARIZONA STATE UNIV TEMPE DEPT OF MATHEMATICS

(U) Spatio-Temporal Complexity and Large-Scale Structures in Problems of Continuum Mechanic.

DESCRIPTIVE NOTE: Final rept. 1 Sep 89-15 Jul 93,

JUL 93 13P

PERSONAL AUTHORS: Nicolaenko, Basil; Armbruster, Dieter; Eden, Alp; Kostelich, Eric

CONTRACT NO. AFOSR-89-0507

PROJECT NO. 3484

TASK NO. D7

MONITOR: AFOSR, XC  
TR-94-0144, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We have investigated some difficulties in estimating dynamics from time-delay embeddings of experimental data that can be characterized as low-dimensional. A new procedure is developed to reduce noise by exploiting the properties of saddle periodic orbits on the reconstructed attractor. Most of these methods involve the estimation of a derivative from the data or in some way require a least squares estimate of the location of some portion of the attractor. Our work addresses some of the problems inherent in the estimation of dynamics from data, regardless of the type of model used to approximate the dynamics. These difficulties may arise from the fractal structure of the attractor and errors in all the observations. The problems persist regardless of the amount of available data and affect one's ability to determine an accurate local model of the dynamics, even when an accurate model should be obtainable in principle. Many of these problems can be circumvented by using as much dynamical information as possible in the formulation of the statistical relationship between the observations. Our attempt to do this involves the use of recurrent orbits to derive an accurate linear model of the dynamics-in the vicinity of saddle periodic orbits on the attractor. We have applied our method to two experimental data sets from Taylor-

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Couette flows.

DESCRIPTORS: (U) \*COUETTE FLOW, \*TURBULENT FLOW, \*CONTINUUM MECHANICS, ESTIMATES, EXPERIMENTAL DATA, FORMULATIONS, FRACTALS, NOISE REDUCTION, ERROR ANALYSIS, TIME DEPENDENCE, ORBITS, STRUCTURES, LEAST SQUARES METHOD, NAVIER STOKES EQUATIONS, TWO DIMENSIONAL, REYNOLDS NUMBER, CHAOS.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484D7, Saddle periodic orbits, Exponential attractors, Inertial manifolds, Kolmogorov flow, Manifolds (mathematics), Taylor Couette flow.

AD-A278 472 17/1

TEXAS A AND M UNIV COLLEGE STATION DEPT OF ELECTRICAL ENGINEERING

(U) Nonlocal Methods for Signal Detection and Estimation in the Dependent Nonstationary Environment.

DESCRIPTIVE NOTE: Final rept. 1 Jul 91-30 Nov 93,

NOV 93 10P

PERSONAL AUTHORS: Halverson, Don

CONTRACT NO. AFOSR-91-0267

PROJECT NO. 2304

TASK NO. A6

MONITOR: AFOSR, XC  
TR-94-0169, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We have obtained a number of results pertaining to signal detection and estimation, where the underlying random processes are imperfectly known and often possess dependency and/or nonstationarity. Our results heavily emphasize nonlocal methods, that is, methods which allow an imperfectly known distribution to vary substantially and not simply be modeled as local to a nominal. Much of this work features robustness, but we also include research involving nonparametric algorithms. Our results include the design and analysis of the classically robust saddlepoint detector for nominally Laplace noise, development of quantitative nonlocal robustness measures for signal detection, parameter estimation, and the estimation of a random variable (all with dependent data), development of a 'user friendly' concept of average nonlocal robustness (a vast improvement over 'worst case' or 'least favorable' approaches), and an analysis of the stability of the false alarm rate of a classical 'nonparametric' detector (an analysis which uses nonlocal techniques). This work underscores that traditional algorithms, while useful, are limited by their design assumptions and can offer disappointing performance when presented with realistic data which reflects imperfectly known random processes possessing dependency and/or nonstationarity. Our

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quantitative results not only shed light on how bad the situation can be, but how to compensate for it with improved design procedures.

DESCRIPTORS: (U) \*ACOUSTIC DETECTION, \*GAUSSIAN NOISE, \*SIGNAL PROCESSING, ALGORITHMS, SIGNAL TO NOISE RATIO, FALSE ALARMS, RANDOM VARIABLES, TIME DEPENDENCE, OPTIMIZATION, NONPARAMETRIC STATISTICS, WARNING SYSTEMS.

IDENTIFIERS: (U) WUAFOSR2304A6, Nonlocal methods, Nonstationary, Laplace noise, Saddlepoint robust detector.

AD-A278 467 6/5 6/15

ARMED FORCES INST OF PATHOLOGY WASHINGTON DC

(U) Effect of Barbiturates and Hyperoxia on Lipid Peroxidation in Hypoxic Neurons.

DESCRIPTIVE NOTE: Annual technical rept. Apr 92-Apr 93,

APR 93 2P

PERSONAL AUTHORS: Mehm, William J.

CONTRACT NO. F49620-92-U-0166

PROJECT NO. 2312

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0220, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This grant was funded for the project 'Effects of Barbiturates and Hyperoxia on Lipid Peroxidation in Hypoxic Neurons' with Chiger, Anderson and Mehm as investigators. The principle investigator departed before any research began. When a new investigator arrived, we found that the proposed model was not appropriate for the research question. We have proposed a change in the research protocol and principle investigator and have requested a not-cost extension. The proposed protocol is 'Oxygen Tension Effects on Wound Healing Molecular Mechanisms' with Kulesh, Anderson and Mehm as investigators. Since that request has not yet been approved, no research has been done.

DESCRIPTORS: (U) \*BARBITURATES, \*HYPEROXIA, \*LIPIDS, \*HYPOXIA, COSTS, GRANTS, HEALING, MODELS, TENSION, GROWTH(PHYSIOLOGY), HYPERBARIC CONDITIONS, OXYGEN, HYPERBARIC MEDICINE.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312CS.

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WYOMING UNIV LARAMIE DEPT OF PHYSICS AND ASTRONOMY

CHICAGO UNIV IL

(U) Traineeship Augmentation for Aerosol Optical Properties Study.

(U) Temperature Dependence and Anharmonicity of Phonons on Ni(110) and Cu(110) Using Molecular Dynamics Simulations,

DESCRIPTIVE NOTE: Annual rept. 1 Aug 92-31 Jul 93,

JUL 93 3P

JAN 94 13P

PERSONAL AUTHORS: Rosen, James M.

PERSONAL AUTHORS: Koleske, D. D.; Sibener, S. J.

CONTRACT NO. F49620-92-J-0427

MONITOR: AFOSR, XF  
TR-94-0214, AFOSR

PROJECT NO. 3484

UNCLASSIFIED REPORT

TASK NO. E4

MONITOR: AFOSR, XF  
TR-94-0214, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) The purpose of this research is to develop a diverse family of optical devices for measuring optical properties of the free troposphere and obtain data sets study these properties. Efforts to design and construct several components of an aerosol calibration system were completed. A series of preliminary field measurements using these new components was completed and the results were favorable. The effort of work under this EPSCOR grant has had a significant impact on the parent grant.

DESCRIPTORS: (U) \*AEROSOLS, \*OPTICAL PROPERTIES, \*TROPOSPHERE, CALIBRATION, GRANTS, IMPACT, MEASUREMENT, MEASURING INSTRUMENTS.

IDENTIFIERS: (U) PES1103D, WUAFOSR3484E4.

Availability: Pub. in Surface Science, v298 p215-224, 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Molecular dynamics simulations were performed for Ni(110) and Cu(110) using Finnis-Sinclair model potentials. During the simulations the temperature dependencies of the mean-square displacements (MSD), the layer-by-layer stress tensors, and the surface phonon spectral densities were measured. A more pronounced increase in the MSD perpendicular to the atomic rows was observed as the temperature was increased as compared to either the other in-plane direction or along the surface normal. Also, at each temperature studied, the MSD along the direction normal to the surface were always larger in the second layer than in the first. Our calculations reveal that the surface phonon frequencies all decrease linearly with increasing temperature. Moreover, the surface phonon linewidths increase linearly with T at low T, and then exhibit an increased sensitivity to temperature variation, changing from a T to T<sup>2</sup> dependence, approximately 150 deg before the onset of defect creation at the surface. These simulation results imply that the Ni(110) and Cu(110) surfaces do not extensively roughen before the onset of adatom-defect formation, and, in confirmation of experimental findings, that the rapid decrease of specular intensity for helium or electron scattering at elevated temperatures is due to the influence of anharmonicity in the surface potential.

DESCRIPTORS: (U) \*PHONONS, \*SIMULATION, \*SURFACES, \*NICKEL, \*COPPER, ADATOMS, DENSITY, DISPLACEMENT, DYNAMICS, ELECTRON SCATTERING, FREQUENCY, HELIUM,

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INTENSITY, LAYERS, MODELS, SENSITIVITY, TENSORS,  
VARIATIONS, REPRINTS, STRESSES, DEFECT ANALYSIS.

JOINT INST FOR LAB ASTROPHYSICS BOULDER CO

(U) Pressure Broadening and Collisional Narrowing in  
OH( $v=1$  Reverses O Rovibrational Transitions with Ar,  
He, O<sub>2</sub> and N<sub>2</sub>.)

IDENTIFIERS: (U) \*Anharmonicity, \*Molecular dynamics,  
Mean square displacements, \*Temperature dependence.

FEB 94 8P

PERSONAL AUTHORS: Schiffman, A.; Nesbitt, D. J.

CONTRACT NO. AFOSR-90-0055

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0148, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Chemical Physics, v100 n4  
p2677-2689, 15 Feb 94. Available only to DTIC users. No  
copies furnished by NTIS.

ABSTRACT: (U) Line shapes are measured for OH ( $v=1$   
reverses O) transitions in the presence of Ar, He, O<sub>2</sub>,  
and N<sub>2</sub> as a function of N rotational, spin orbit, and  
lambda doublet state. Pressure broadening coefficients  
for all transitions and buffer gases are determined from  
fits of the observed line shapes to the Voigt profile.  
The dependencies of the observed broadening coefficients  
on the OH quantum levels are discussed and compared with  
previous pressure broadening studies in HF and NO. The  
observed OH line shapes are interpreted in terms of their  
impact on the determination of mesospheric and  
stratospheric OH populations, temperatures, and quantum  
state distributions from OH nightglow and dayglow  
emission. In the case of OH + Ar, evidence for Dicke  
narrowing is presented, and narrowing coefficients are  
reported from fits to a 'hard collision' model. Airglow,  
Flash kinetic spectroscopy, High resolution, OH,  
Potential energy surfaces, Pressure broadening, Radicals.

DESCRIPTORS: (U) \*PRESSURE, \*COLLISIONS, \*HYDROXYL  
RADICALS, \*ARGON, \*HELIUM, \*OXYGEN, \*NITROGEN, AIRGLOW,  
BUFFERS, COEFFICIENTS, DISTRIBUTION, EMISSION, ENERGY,  
FLASHES, FUNCTIONS, HIGH RESOLUTION, IMPACT, KINETICS,

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## DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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MODELS, ORBITS, POPULATION, POTENTIAL ENERGY, PROFILES, SHAPE, SPECTROSCOPY, SURFACES, TEMPERATURE, TRANSITIONS, REPRINTS, SPIN STATES, ATMOSPHERIC CHEMISTRY, CHEMICAL RADICALS.

PENNSYLVANIA UNIV PHILADELPHIA

(U) L12 Al<sub>3</sub>Ti-Based Alloys with Al<sub>2</sub>Ti Precipitates-I. Structure and Stability of the Precipitates,

IDENTIFIERS: (U) \*Broadening, Line shapes, \*Narrowing, \*Rotational transitions

94 11P

PERSONAL AUTHORS: Wu, Z. L.; Pope, D.

PROJECT NO. 2306

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0147, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Acta Metallurgica Materials, v42 n2 p509-518 1994. Proceedings, v288 p447-452, 1993.  
Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The Al<sub>2</sub>Ti-based commonly seen in L12Al<sub>3</sub>Ti alloys has been studied in detail, using Fe- and Cr-modified single crystalline specimens. The formation of the phase was found to be temperature-dependent: in an in situ TEM heat treatment it was observed that the phase started to dissolve at about 750 deg C, and is mostly dissolved by 1000 deg C. The volume fraction of the phase increases with Ti content, but the composition of the phase is largely controlled by the overall Al/Fe ratio. Based on two-surface trace analysis it was determined that Al<sub>2</sub>Ti forms as platelets on the cube planes of the L12, matrix. X-ray powder diffraction and computer simulation of the X-ray spectra revealed that it has a tetragonal structure of the Ga<sub>2</sub>Hf type, the same as that of binary Al<sub>2</sub>Ti. Due to the presence of ternary elements the lattice parameters of the phase are changed such that it can form coherently on the cube planes of the L12 matrix. Special crystallographic orientation relations exist between the two phases: (100)p/(100)m and (010)p/(010)m, where m and p mean matrix and precipitate, respectively. It was observed using TEM that the precipitates act as strong barriers for dislocation motion on octahedral slip planes in the matrix.

DESCRIPTORS: (U) \*PRECIPITATES, \*ALUMINUM, \*TITANIUM ALLOYS, ALLOYS, BARRIERS, DISLOCATIONS, HEAT TREATMENT,

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MEAN, MOTION, PARAMETERS, PHASE, POWDERS, RATIOS, SIMULATION, STRUCTURES, SURFACES, X RAY SPECTRA, REPRINTS, STABILITY, IRON, CHROMIUM, SINGLE CRYSTALS, X RAY DIFFRACTION.

PENNSYLVANIA UNIV PHILADELPHIA

(U) Flow Behavior of the L12 (Al, Fe)3Ti Single Crystals,

93 7P

IDENTIFIERS: (U) PEG1102F, WUAFOSR2306AS.

PERSONAL AUTHORS: Wu, Z. L.; Pope, D.; Vitek, V.

PROJECT NO. 2306

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0180, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Materials Research Society Symposium Proceedings, V288 p447-452, 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The compressive flow behavior of single crystalline L12 Al67Fe8Ti25 was investigated as a function of temperature and orientation at temperatures from 77K to about 1250K, using specimens with compressive axes orientated near (001), (113), (011), (122) and (111). The operating slip systems seen in these specimens after 0.4% plastic deformation are predominantly of the octahedral type at all temperatures, even in near-(122) and (111) specimens in which the Schmid factors for the primary cube slip system are larger than that for the primary octahedral slip system. The yield stress increases rapidly with decreasing temperature at low temperatures, while it decreases gradually from room temperature to higher temperatures. The critical resolved shear stress (CRSS) on the (101)(111) slip system does not seem to be orientation-dependent over a wide range of temperatures, except at temperatures from 1050K to 1250K where the CRSS exhibits a mild orientation-dependence. Fracture tests at room temperature were also conducted. No special orientation-dependence of the ductility was observed.

DESCRIPTORS: (U) \*BEHAVIOR, \*FLOW, \*ALUMINUM, \*IRON, \*ALUMINIDES, \*SINGLE CRYSTALS, \*COMPRESSIBLE FLOW, AXES, DUCTILITY, FUNCTIONS, PLASTIC DEFORMATION, REDUCTION, ROOM TEMPERATURE, TEST AND EVALUATION, YIELD, STRESSES, REPRINTS, ALLOYS.

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IDENTIFIERS: (U) PE61102F, WUAFOSR2308AS, Slip systems, CRSS(Critical Resolved Shear Stress)

ILLINOIS UNIV AT URBANA DEPT OF MATERIALS SCIENCE AND ENGINEERING

(U) Displacive Transformation in Ceramics.

DESCRIPTIVE NOTE: Final rept. 15 Mar 90-30 Sep 93,

FEB 94 565P

PERSONAL AUTHORS: Kriven, W. M.; Wayman, C. M.; Payne, D. A.; Chen, H.; Bass, J. D.

CONTRACT NO. AFOSR-90-0174

PROJECT NO. 3484

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0151, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) An interdisciplinary study of displacive phase transformations in ceramics has been undertaken. The unifying themes were to obtain an in-depth understanding of (1) nucleation and (2) transformation mechanisms. The ceramic systems focused on, and studied from different perspective, included lead titanate (PbTiO<sub>3</sub>), potassium niobate (KNbO<sub>3</sub>), yttrium barium copper oxide (YBa<sub>2</sub>Cu<sub>3</sub>O<sub>6+x</sub>) and dicalcium silicate (Ca<sub>2</sub>SiO<sub>4</sub>). The cubic to tetragonal transformation in PbTiO<sub>3</sub> was proven to be martensitic, and the experimental observations illustrated a predicted theoretical mechanism of common habit plane variants which had not yet been observed in any other system. Shape memory and superelasticity effects were discovered in doped PbTiO<sub>3</sub> ceramics which exhibited field-induced antiferroelectric to ferroelectric transformations. The effect of oxygen partial pressures on the transformation mechanism and microstructure in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>6+x</sub> single crystals, leading to elastic deformation, has been ascertained. A comprehensive understanding of the complex sequence of ferroelastic transformations in Ca<sub>2</sub>SiO<sub>4</sub> with volume changes up to 12 % has been achieved. For the first time, a case study of martensitic nucleation in a KNbO<sub>3</sub> ceramic has almost been assembled, with complementary aspects of theoretical lattice dynamics, phonon properties, (RT)

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elastic moduli and in situ hot stage TEM microstructural studies having been determined prior to and during transformation. Ceramics, Displacive phase transformations, Martensitic nucleation, Precursor phenomena, Plastic properties, Mechanisms, Crystallography, Lattice dynamic theory

DESCRIPTORS: (U) \*CRYSTALLOGRAPHY, \*LEAD TITANATES, \*NIOBATES, \*PHASE TRANSFORMATIONS, \*POTASSIUM, \*SILICATES, \*CERAMIC MATERIALS, BARIUM, CASE STUDIES, COPPER, CRYSTALS, DEFORMATION, DEPTH, LATTICE DYNAMICS, MICROSTRUCTURE, NUCLEATION, OXIDES, OXYGEN, PHONONS, PRECURSORS, PRESSURE, SEQUENCES, SHAPE, SINGLE CRYSTALS, THEORY, TIME, TITANATES, VOLUME, YTTRIUM, ELASTIC PROPERTIES, ELECTRONICS.

IDENTIFIERS: (U) WUAFOSR3484CS, PE61103D, \*Displacive, Martensitic

CALSPAN UB RESEARCH CENTER BUFFALO NY

(U) Experimental Studies of the Mean and Fluctuating Characteristics of Hypersonic Turbulent Boundary Layers.

DESCRIPTIVE NOTE: Final rept. 1 Jul 91-31 Aug 93,

DEC 93 135P

PERSONAL AUTHORS: Holden, Michael S.

CONTRACT NO. AFOSR-91-0273

PROJECT NO. 2307

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0156, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The objective of this program of fundamental research in turbulent flows is to advance the experimental knowledge of the detailed structure and turbulent mechanisms in regions of attached and separated turbulent hypersonic flows. The experimental program is being conducted in high Reynolds number hypersonic flows for high-enthalpy conditions where compressibility and turbulent non-equilibrium effects are believed to be of key importance. Three basic studies are being conducted under the current effort. The first is an experimental program in which detailed characteristics of the turbulent structures are being obtained using electron-beam techniques. In the second study, we have examined transitional and turbulent flows along the stagnation line of a highly-swept cylinder. In the third program segment, we have been analyzing and compiling a database of detailed experimental measurements which will be used as a basis for code validation studies. During the past year these studies have been presented and discussed in a number of informal and formal meetings including an ALAA presentation in Huntsville. Turbulent flows, Mechanisms, Electron-beam techniques, Transitional and turbulent flows, Stagnation line, Cylinder, Code validation, Database.

DESCRIPTORS: (U) \*HYPERSONIC FLOW, \*TURBULENT BOUNDARY

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LAYER, \*AERODYNAMIC CONFIGURATIONS, \*TURBULENT FLOW,  
\*AEROSPACE CRAFT, COMPRESSIVE PROPERTIES, DATA BASES,  
ELECTRON BEAMS, ELECTRONS, ENTHALPY, REYNOLDS NUMBER,  
STAGNATION, VALIDATION, BOUNDARY LAYER TRANSITION,  
CYLINDRICAL BODIES, VISCOUS FLOW, INVISCID FLOW, WIND  
TUNNEL TESTS.

WAKE FOREST UNIV WINSTON-SALEM NC DEPT OF PHYSIOLOGY AND  
PHARMACOLOGY

(U) Neostriatal Neuronal Activity and Behavior.

DESCRIPTIVE NOTE: Final rept. 1 Jun 92-30 Sep 93,

SEP 93 4P

IDENTIFIERS: (U) WUAFOSR2307AS, PES1102F.

PERSONAL AUTHORS: Woodward, Donald J.

CONTRACT NO. F49620-92-J-0301

PROJECT NO. 3484

TASK NO. HS

MONITOR: AFOSR, XC  
TR-94-0175, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The overall goal of the 'University Initiative' project 'Neostriatal Neuronal Activity and Behavior' was to establish a new technical approach for the study of ensembles of single neurons in CNS during tasks requiring sensory motor integration. An aim was to establish methodology for chronic implant of arrays of recording electrodes in rat neostriatum and other regions. Instrumentation was to be developed to allow amplification and spike sorting to be done for up to 64 concurrent spike trains. An acquisition system was to record the time events of spike trains, stimuli, and behavior events for up to four days continuously. An analysis capability was to provide a wide range of standard analysis procedures including histograms and rasters. A new approach for neuron ensemble analysis was to be developed to deal with statistical fluctuations of ensemble patterned activity across trials. Experimental studies were to study neuronal population activity during a series of tasks including tone and treadmill locomoting and a delayed matching-to-sample task with a spatial memory requirement. Computational simulation was to be done to explore short-term memory properties of the local circuitry between medium spiny neurons in neostriatum. Development of the experimental approach was the primary goal. Extended experimental analysis was secondary for this type of developmental project.

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF  
MATERIALS SCIENCE AND ENGINEERING

DESCRIPTORS: (U) \*BEHAVIOR, \*NERVE CELLS, \*NEURAL NETS,  
\*MEMORY(PSYCHOLOGY), ACQUISITION, AMPLIFICATION, APPROACH,  
ARRAYS, ELECTRODES, HISTOGRAMS, INSTRUMENTATION,  
INTEGRATION, MATCHING, METHODOLOGY, MOTORS, POPULATION,  
RASTERS, RATS, RECORDS, REGIONS, REQUIREMENTS, SIMULATION,  
SORTING, SPIKES, STANDARDS, STIMULI, TIME, TREADMILLS,  
UNIVERSITIES, SHORT RANGE(TIME).

(U) Microstructures and Epitaxy in Oxide Superconductor  
Thin Films and Devices.

DESCRIPTIVE NOTE: Final rept. 1 Feb 92-31 Jan 94,

MAR 94 17P

IDENTIFIERS: (U) Neostriatal neuronal.

PERSONAL AUTHORS: Carim, Altaf H.

CONTRACT NO. F49620-92-J-0159

PROJECT NO. 2305

TASK NO. GS

MONITOR: AFOSR, XC  
TR-94-0191, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report summarizes the work performed at the Pennsylvania State University (PSU) and the Westinghouse Science and Technology Center (WSTC) under the project entitled 'Microstructure and Epitaxy in Oxide Superconductor Thin Films and Devices', AFOSR Grant F49620-92-J-0159, under the direction of the principal investigator, Prof. A. H. Carim. The total period of the project was from February 1, 1992 to January 31, 1994. Results over the first year of the award, from February 1, 1992 through January 31, 1993, were summarized in the annual (interim) report submitted earlier. The present document will therefore focus on the more recent activities during the second year of the project.

DESCRIPTORS: (U) \*SUPERCONDUCTORS, \*THIN FILMS,  
\*EPITAXIAL GROWTH, \*OXIDES, ELECTRON MICROSCOPY,  
GROWTH(GENERAL), HIGH TEMPERATURE.

IDENTIFIERS: (U) WUAFOSR2305GS.

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COLUMBIA UNIV NEW YORK

(U) Hydrogen Donating Solvent Participation in the Photochemistry of Benzaldehyde and Deoxybenzoin: A 13C CIDNP Study,

94 7P

PERSONAL AUTHORS: Hwang, Kuo C.; Turro, Nicholas J.; Roth, Heinz D.

CONTRACT NO. AFOSR-91-0340

PROJECT NO. 2303

TASK NO. B2

MONITOR: AFOSR, XC  
TR-84-0174, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in The Intl. of Organic Chemistry, v59 n5 p1102-1107, 1994. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Photolysis of benzaldehyde (1; 90% 13C=0 in cyclohexane-d sub 12 results in the formation of benzyldehyde-h and -d with emissive CIDNP for the 13C=0 function. This observation requires a secondary encounter of a free benzoyl radical with either phenylhydroxymethyl or cyclohexyl-d sub 11 radicals. Photolysis of deoxybenzoin (5:99% 13C=0) and p-chloro-5 (99% 13C=0) in cyclohexane-d sub 12 also generates benzaldehyde-h and -d with the same emissive CIDNP for the 13C=0 function. These observations are rationalized in terms of a previously unreported primary intermolecular deuterium abstraction by photoexcited deoxybenzoin from the (deuterated) solvent. This assignment is supported by the significantly decreased measured lifetime of triplet deoxybenzoin in cyclohexane-h and -d (428 and 724 ns, respectively) compared to the lifetime in benzene (847 ns). Photochemistry, Chemically induced nuclear polarization (CIDNP), Chemically induced electron polarization (CIDEP), Dynamic nuclear polarization (DNP).

DESCRIPTORS: (U) \*BENZALDEHYDES, \*PHOTOCHEMICAL REACTIONS, \*PHOTOLYSIS, \*SOLVENTS, \*HYDROGEN, BENZENE,

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UNIVERSITY OF CENTRAL FLORIDA ORLANDO

DESCRIPTORS: (U) \*MICROSCOPES, \*SOFT X RAYS, DEBRIS,  
PLASMAS(PHYSICS), SHORT WAVELENGTHS, HIGH RESOLUTION,  
MICROSCOPY, MEASUREMENT, PHOTONS, REFLECTION, WINDOWS, X  
RAY LASERS, X RAYS.

(U) Simplified Ultra-High Resolution Optic for Soft-X-Ray  
Imaging.

DESCRIPTIVE NOTE: Final rept. 1 Jul 92-31 Dec 93,

IDENTIFIERS: (U) WUAFOSR2301BS, Schwarzschild microscope,  
Water windows.

DEC 93 10P

PERSONAL AUTHORS: Silfvast, W. T.

CONTRACT NO. F49620-92-J-0405

PROJECT NO. 2301

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0192, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) In this report, we outline the design considerations and construction of an EUV reflection imaging microscope. The parameters of the microscope and the debris measurements of the source are presented. The reasons for selecting a laser-produced plasma (LPP) source and a Schwarzschild objective are described. While most research efforts for the development of soft-x-ray sources such as soft-x-ray lasers pursue the generation of shorter and shorter wavelengths down to the water window, the EUV and soft-x-ray spectral regions are also ideal wavelengths for applications in chemistry and biology due to the photon energy being close to the molecular bond energy. In this report, we outline the design considerations and construction of an EUV reflection imaging microscope. The parameters of the microscope and the debris measurements of the source are presented. The reasons for selecting a laser-produced plasma (LPP) source and a Schwarzschild objective are described. While most research efforts for the development of soft-x-ray sources such as soft-x-ray lasers pursue the generation of shorter and shorter wavelengths down to the water window, the EUV and soft-x-ray spectral regions are also ideal wavelengths for applications in chemistry and biology due to the photon energy being close to the molecular bond energy.

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STANFORD UNIV CA DEPT OF ELECTRICAL ENGINEERING

(U) Electrical Characteristics of GaAs MESFET Fabrication by Ion Implantation of Si or Se.

DESCRIPTIVE NOTE: Final rept. 5 Jul 89-4 Oct 93,

OCT 93 102P

PERSONAL AUTHORS: Sigmon, T. W.

CONTRACT NO. F49620-89-C-0094, \$ARPA Order-6860

MONITOR: AFOSR, XC  
TR-94-0228, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) Since its synthesis in the 1920s by Goldschmidt, Gallium Arsenide has received much attention in the last few decades. In the mid-1980s, GaAs technology finally matured into the age of production. We saw a boom of companies dedicated to the growth of GaAs materials and the fabrication of GaAs devices and integrated circuits. Although GaAs is no longer being considered a general purpose material like silicon, it is now well established in several niche markets, such as Direct Broadcast Satellite, Microwave Monolithic Integrated Circuits and Optoelectronics.

DESCRIPTORS: (U) \*SILICON, \*SELENIUM, \*ION IMPLANTATION, \*GALLIUM ARSENIDES, \*ELECTRICAL PROPERTIES, \*METALS, \*SEMICONDUCTORS, \*FIELD EFFECT TRANSISTORS, CRYSTAL GROWTH, EPITAXIAL GROWTH, POISSON EQUATION, DEFECT ANALYSIS, FABRICATION, SOLID STATE ELECTRONICS.

IDENTIFIERS: (U) \*MESFET(Metal Semiconductor Field Effect Trasistor), Continuity equation, EL2

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CALIFORNIA UNIV LOS ANGELES DEPT OF CHEMISTRY AND BIOCHEMISTRY

(U) First-Principles-Derived Dynamics of F2 Reactive Scattering on Si(100)-2X1.

FEB 94 11P

PERSONAL AUTHORS: Carter, Lawrence E.; Khodabandeh, Shervin; Weakliem, Paul C.; Carter, Emily A.

CONTRACT NO. F49620-93-1-0145

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0178, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in the Jnl. of Chemical Physics, V100 n3 p2277-2288, 1 Feb 94. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) We have simulated via molecular dynamics the interaction of F2 with the clean Si(100)-2 x 1 reconstructed surface. Using a Stillinger-Weber-type many-body potential with the Si-F interactions refit to ab initio data, we find that both vibrational and translational excitation of the incident F2 can lead to increased reactivity, but they do so in different ways. The dominant reaction channels are (a) F-atom abstraction, leading to the formation of one Si-F bond while the remaining fluorine atom is ejected away from the surface, and (b) dissociative chemisorption, where both fluorine atoms in the incident F2 molecule form Si-F bonds on the surface. Nonreactive scattering is almost never observed. As a result, enhanced reactivity is mainly characterized by an increase in dissociative chemisorption at the expense of F-atom abstraction and by a corresponding increase in the initial reaction probability S(sub O). We find S(sub O) ranges from 0.57 + or = 0.04 for the lowest excitation energies to 0.78 + or = 0.04 for the largest translational excitation of 20.9 kcal/mol. For cases where F-atom abstraction occurs, the exit velocities of fluorine atoms ejected from the surface are

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found to be independent of the incident F2 energy and with kinetic temperatures much higher than the surface temperature, suggesting that the exiting fluorine atom does not equilibrate with the surface, yet loses memory of its initial state. Finally, for dissociative chemisorption trajectories, we find that the adsite location of the two fluorine atoms is strongly dependent on the incident orientation.

DESCRIPTORS: (U) \*DYNAMICS, \*FLUORINE, \*REACTIVITIES, \*SCATTERING, \*SILICON, \*MOLECULE MOLECULE INTERACTIONS, \*FLUORIDES, \*ETCHING, ATOMS, CHANNELS, CHEMISORPTION, ENERGY, EXCITATION, KINETICS, MOLECULES, PROBABILITY, SURFACE TEMPERATURE, TEMPERATURE, TRAJECTORIES, VELOCITY, REPRINTS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2303FS, First-principles-derived, Chemical physics

YALE UNIV NEW HAVEN CT SCHOOL OF MEDICINE

(U) Stress-Induced Enhancement of the Startle Reflex.

DESCRIPTIVE NOTE: Final rept. 1 Oct 90-30 Sep 93,

SEP 93 8P

PERSONAL AUTHORS: Davis, Michael

CONTRACT NO. AFOSR-91-0035

PROJECT NO. 2312

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0173, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) A major goal of the work funded by the Air Force has been to evaluate the role of the amygdala in both conditioned and unconditioned fear and anxiety. This work showed that the central nucleus of the amygdala, and its direct projection to a particular part of the acoustic startle pathway, were critically involved in the performance or expression of fear-potentiated startle.

DESCRIPTORS: (U) \*DRUGS, \*FEAR, \*LESIONS, \*REFLEXES, \*CONDITIONED RESPONSE, ACOUSTICS, AIR FORCE, ANXIETY, WORK, LEARNING, SHOCK.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312AS, \*Startle reflex, Startle pathway, Amygdala, Buspirone.

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OHIO UNIV ATHENS DEPT OF ELECTRICAL AND COMPUTER  
ENGINEERING

(U) Luminescence and Electroluminescence of Nd, Tm and Yb  
Doped GaAs and some II-VI compounds.

DESCRIPTIVE NOTE: Final rept. Jul 90-Nov 93,

FEB 94 89P

PERSONAL AUTHORS: Lozykowski, Henryk J.

CONTRACT NO. AFOSR-90-0322

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-0241, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report describes the progress accomplished during the three year of research on photoluminescence and electroluminescence properties of Nd, Tm, Yb doped, InP, GaAs, CdS, and ZnS. The results are as follow: (1) We developed the kinetics model of energy transfer from the host lattice to the localized core excited state of rare earth isoelectronic structured traps. The energy transfer processes occur through an Auger mechanism where the recombination energy of the bound electron with a free hole is transferred nonradiatively to the core states. (or energy can be transferred from the bound exciton on an REI-trap to the core states). If the initial and final states are not resonant, the energy mismatch must be accommodated by emission or absorption of phonons. Furthermore we discuss details of several quenching processes, which are incorporated into the kinetics equations. The derived two sets of differential equations for semi-insulating, and n type semiconductors governing the kinetics of rare earth luminescence. The numerically simulated luminescence rise and decay times show a good quantitative agreement with experimental data obtained for InP: Yb, over a wide range of excitation intensity. The photoluminescence spectra and decay time also studied as a function of temperature. The new quenching mechanism of ytterbium luminescence

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Involving Yb and Fe ions is proposed. The electric field quenching of InP: Yb photoluminescence was investigated for the first time. (2) The photoluminescence kinetics as a function of excitation intensity in n and p type InP: Yb, and GaAs: Nd grown by MOCVD was studied at 1.8 K and 77 K.

DESCRIPTORS: (U) \*ELECTROLUMINESCENCE, \*LUMINESCENCE, \*PHOTOLUMINESCENCE, ABSORPTION, AGREEMENTS, AUGERS, CORES, DECAY, DIFFERENTIAL EQUATIONS, ELECTRIC FIELDS, ELECTRONS, EMISSION, ENERGY, ENERGY TRANSFER, EQUATIONS, EXCITATION, EXCITONS, EXPERIMENTAL DATA, FUNCTIONS, GALLIUM ARSENIDES, INTENSITY, IONS, KINETICS, MODELS, N TYPE SEMICONDUCTORS, PHONONS, POLARIZATION, QUENCHING, REDUCTION, SEMICONDUCTORS, SPECTRA, SPECTROSCOPY, TEMPERATURE, TIME, TRANSFER, TRAPS, YTTERBIUM, EXCITATION, GROUP II-VI COMPOUNDS, IMPACT, INTENSITY, LOW TEMPERATURE, ROOM TEMPERATURE, SYMMETRY, VOLTAGE.

IDENTIFIERS: (U) WUAFOSR30055S.

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DTIC REPORT BIBLIOGRAPHY

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MINNESOTA UNIV MINNEAPOLIS DEPT OF PSYCHOLOGY

TEXAS UNIV AT AUSTIN DEPT OF ELECTRICAL AND COMPUTER  
ENGINEERING

(U) Workshop on Visual Perception: Computation and  
Psychophysics Held in Chatham, Massachusetts on 14-17  
January 1993.

DESCRIPTIVE NOTE: Final rept. 15 Jan 93-14 Jan 94,

MAR 94 15P

FEB 94 10P

PERSONAL AUTHORS: Knill, David C.; Richards, Whitman

PERSONAL AUTHORS: Gunzburger, ; Arapostathis, Aristotle

CONTRACT NO. F49620-93-1-0124

CONTRACT NO. F49620-92-J-0083

PROJECT NO. 2313

PROJECT NO. 2304

TASK NO. AS

TASK NO. AS

MONITOR: AFOSR, XC

MONITOR: AFOSR, XC  
TR-94-0218, AFOSR

TR-94-0219, AFOSR

UNCLASSIFIED REPORT

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ABSTRACT: (U) The workshop brought together researchers in computational vision and psychophysics to discuss ways of conceptualizing and modeling problems in visual perception. Such a conceptualization requires common frameworks for formulating problems in perception. Workshop participants considered what formal tools and structures these frameworks should provide in order to be most useful for the study of human vision. Several recently proposed frameworks based on the formulation of Bayesian, probabilistic inference served as the focal point for evaluation and discussion. Vision, Perception, Computation, Psychophysics, Bayes, Probabilistic inference.

DESCRIPTORS: (U) \*COMPUTATIONS, \*VISUAL PERCEPTION, FORMULATIONS, HUMANS, PERCEPTION, PSYCHOPHYSICS, STRUCTURES, TOOLS, VISION, WORKSHOPS, IMAGES, MEMORY(PSYCHOLOGY).

IDENTIFIERS: (U) PE61102F, WUAFOSR2313AS, Neural network model.

ABSTRACT: (U) Significant progress was made in a number of aspects of nonlinear and stochastic systems. Important contributions in the adaptive control of finite state Markov chains under partial observations were solved, and significant progress was made along more general directions. A project in surveying the literature on the ergodic control problem for discrete-time controlled Markov processes was completed. This work presented a comprehensive account of the considerable research on this problem over the past three decades. Further extending this effort, we embarked on writing a research monograph entitled 'Ergodic Control of Markov Chains and Stochastic Games' intended for publication as a volume in the series of 'Applications of Mathematics' by Springer-Verlag. A controlled switching diffusion model was developed to study the hierarchical control of flexible manufacturing systems. This study led to significant results in optimal control of stochastic hybrid system in both the discounted and average cost cases. In the area of deterministic nonlinear systems, numerical aspect of approximation linearization were investigated.

DESCRIPTORS: (U) \*MARKOV PROCESSES, \*NONLINEAR SYSTEMS, \*ADAPTIVE CONTROL SYSTEMS, CHAINS, COSTS, DIFFUSION, HYBRID SYSTEMS, MANUFACTURING, OBSERVATION, PROBABILITY, SWITCHING, TIME, WRITING, APPLIED MATHEMATICS.

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MATHEMATICAL MODELS.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2304AS.

AD-A278 410 25/2 12/9

CALIFORNIA INST OF TECH PASADENA DEPT OF ELECTRICAL  
ENGINEERING

(U) Reliable Communication in the Presence of Severe Noise  
or Jamming.

DESCRIPTIVE NOTE: Final rept. 1 Oct 90-30 Sep 93,

SEP 93 4P

PERSONAL AUTHORS: McEliece, Robert J.

CONTRACT NO. AFOSR-91-0037

PROJECT NO. 2304

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0210, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) It has been shown that the ultimate limits  
for some classes of multi-user communications systems can  
be computed by single linear programs. This theory can be  
applied to ordinary telephone networks and to TDMA  
communications networks.

DESCRIPTORS: (U) \*COMMUNICATIONS NETWORKS, \*INFORMATION  
THEORY, \*TELEPHONE SYSTEMS, MULTIPLE ACCESS, COMPUTATIONS,  
LINEAR PROGRAMMING, RELIABILITY, NOISE, JAMMING.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2304DS, Multiuser  
communications.

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HAYSTACK OBSERVATORY WESTFORD MA

IDENTIFIERS: (U) PE61102F, WUAFOSR2310BS, Millstone Hill radar.

(U) Millstone Hill Radar Studies of Plasma Waves and Turbulence.

DESCRIPTIVE NOTE: Annual rept. Nov 92-Oct 93,

MAR 94 8P

PERSONAL AUTHORS: Foster, John C.

CONTRACT NO. F49620-93-1-0019

PROJECT NO. 2310

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0223, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The Millstone Hill UHF radar was used as a diagnostic tool for investigating plasma waves and turbulence. During the 15-month interval covered by the first year of this award, experiments were performed using an alternating-code technique in order to assess this capability for use as a plasma diagnostic. Experiments at fixed antenna position and with real-time interaction investigated phenomena near perpendicular flow angle when looking very close to perpendicular magnetic aspect angle conditions. Analysis of prior data showed that when flow angle is varied through per while holding 0 degree aspect angle, an abrupt change in sign of the line of sight phase velocity is observed. Preparations were continued for bistatic coherent backscatter experiments in FY'94 using the MIDAS-C data acquisition system developed at Millstone Hill for use as a bistatic receiver in Canada. Ionosphere, Radar, Radar clutter, Plasmas.

DESCRIPTORS: (U) \*IONOSPHERE, \*PLASMA DIAGNOSTICS, \*RADAR, \*TURBULENCE, ANTENNAS, ASPECT ANGLE, CLUTTER, DATA ACQUISITION, FLOW, INTERACTIONS, LINE OF SIGHT, PHASE VELOCITY, PLASMA WAVES, RADAR CLUTTER, REAL TIME, RECEIVERS, ULTRAHIGH FREQUENCY, RADAR ANTENNAS, BACKSCATTERING, BISTATIC RADAR.

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AD-A278 408 20/2

CRYSTAL SYSTEMS INC SALEM MA

(U) Development of Materials for Spectral Hole Burning Applications.

DESCRIPTIVE NOTE: Final rept. 18 Jun 93-15 Feb 94,

FEB 94 27P

PERSONAL AUTHORS: Khattak, Chandra P.; Lesiczka, John A.; Schmid, Frederick

CONTRACT NO. F49620-93-C-0035

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
TR-94-0242, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) It was intended to evaluate growth of europium-doped yttrium aluminum oxide (Eu:Y3Al5O12, Eu:YAG) and europium-doped yttrium silicate (Eu:Y2SiO5, Eu:YSO) crystals to characterize these crystals for spectral hole-burning application. After technical discussions at a topical Workshop and agreement of the Technical Monitor, the scope of the program was enlarged to include growth of rare-earth doped mixed-oxide crystals and growth of Eu:YSO was de-emphasized as these crystals were available for characterization. The experimental effort involved producing YAG, YSO and YAlO3 (YALO) host crystals and the dopants Eu, Tm, Tb and Ce. High optical quality crystals of Eu:YAG, Tm:YAG, Tb:YAG and Ce:YAG were fabricated from 6 cm diameter boules grown using the Heat Exchanger Method (HEM). The samples were characterized for absorption as a function of wavelength at-SRI International, Menlo Park, CA. Previously-grown Ce:Gd3Sc2Al3O12(Ce:GSAG) crystal was characterized also. The available data is insufficient for choosing a crystal for spectral hole burning application. It is necessary to explore other rare-earth doped mixed oxide crystals and carry out more characterization. Spectral hole burning, Yttrium aluminum garnet, Heat exchanger method, Crystal growth, Dephasing time.

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DESCRIPTORS: (U) \*HOLES(ELECTRON DEFICIENCIES), \*CRYSTAL GROWTH, ABSORPTION, ALUMINUM OXIDES, DOPING, SPECTROSCOPY, COMBUSTION, CRYSTALS, DIAMETERS, EUROPIUM, SINGLE CRYSTALS, GARNET, HEAT EXCHANGERS, OXIDES, SILICATES, WORKSHOPS, YTTRIUM, YTTRIUM ALUMINUM GARNET.

IDENTIFIERS: (U) SBIR, WUAFDSR3005SS, \*Hole burning, Spectral hole burning.

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CALSPAN UB RESEARCH CENTER BUFFALO NY

(U) Calibration and Validation Studies in the LENS Facility.

TEMPERATURE, TURBULENT FLOW, VELOCITY, INFRARED SPECTROSCOPY, TEST FACILITIES, AEROTHERMODYNAMICS, AIR FLOW, HYPERONS, OPTICAL DETECTION, REFRACTION, REYNOLDS NUMBER.

DESCRIPTIVE NOTE: Final rept. 10 Aug 91-9 Feb 94,

IDENTIFIERS: (U) LENS(Large Energy National Shock), LENS Tunnel

FEB 94 60P

PERSONAL AUTHORS: Holden, Michael

CONTRACT NO. F49620-91-C-0085

PROJECT NO. 2307

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0161, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This report describes recent developments in the LENS facility, flow field calibration studies, and aerothermal and aero-optical measurements to evaluate the turbulent flow field characteristics of seeker head configurations in hypervelocity airflow. The development of the LENS facility to run at pressure levels up to 30,000 psi and temperatures up to 14,000 deg R are reviewed. Issues associated with diaphragm performance, reservoir configuration, throat melting and burning, and modifications to the facility for large recoil loads at high pressure operation are briefly reviewed. Flow field measurements made during calibration studies are compared with computer predictions. Validation studies with simple seeker head aperture configurations in high enthalpy flows are then discussed. The models and aerothermal and aero-optical instrumentation used in these studies are described. The measurements obtained in flows up to 12,000 ft/sec are compared with similar measurements at lower velocities, simple correlation techniques, and detailed computer simulations.

DESCRIPTORS: (U) \*HYPERSONIC FLOW, \*SHOCK TUNNELS, APERTURES, CALIBRATION, COMBUSTION, CONFIGURATIONS, CORRELATION TECHNIQUES, ENTHALPY, FLOW FIELDS, HIGH PRESSURE, INSTRUMENTATION, MEASUREMENT, MELTING, MODELS, MODIFICATION, PREDICTIONS, PRESSURE, RECOIL, SIMULATION,

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CALIFORNIA INST OF TECH PASADENA

(U) How Hints Affect Learning.

DESCRIPTIVE NOTE: Final rept.,

SEP 93 35P

PERSONAL AUTHORS: Abu-Mostafa, Yaser

CONTRACT NO. F49620-92-J-0398

PROJECT NO. 2304

TASK NO. HS

MONITOR: AFOSR, XC  
TR-94-0196, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) The use of hints as an aid in learning from examples is addressed. Hints describe the situation where, in addition to the set of examples of some unknown function  $f$  (that we are trying to learn), we have prior knowledge of certain facts about  $f$ . The use of hints, under different names is coming to the surface in a number of areas dealing with learning and adaptive systems. The most common complaint is that hints are heterogeneous and cannot easily be integrated into learning. The final report describes the development of a systematic method that integrates different types of hints in the same learning process. Algorithms for learning from hints are presented. These algorithms use fixed or adaptive schedules to determine the turn of each hint to be learned in order to achieve balance among the errors of different hints. Also, a theoretical analysis of learning from hints is developed. It is based on the Vapnik-Chervonekis (VC) dimension, which is an established tool for analyzing learning from examples.

**DESCRIPTORS:** (U) \*LEARNING, ADAPTIVE SYSTEMS, ADDITION, ALGORITHMS, BALANCE, ERRORS, FUNCTIONS, NUMBERS, SURFACES, TOOLS, NEURAL NETS, INFORMATION PROCESSING.

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CSA ENGINEERING INC PALO ALTO CA

(U) Structural Integrity of Intelligent Materials and Structures.

DESCRIPTIVE NOTE: Rept. for 1 Jul 93-31 Jan 94,

FEB 94 44P

PERSONAL AUTHORS: Gibson, Warren C.; Fowler, Bryce L.

CONTRACT NO. F49620-93-C-0026

PROJECT NO. 2302

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0166, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) Intelligent materials open new avenues to improve performance, reliability, and longevity of future aerospace vehicle structures by allowing the materials themselves to become active elements for multiple system functions. However, the application of intelligent materials and structures has been inhibited because the effects of microstructural interactions between intelligent and host material elements have heretofore not been well characterized. This research implemented and applied three analytical approaches to the study of stress concentrations and cracking around embedded sensor/actuator elements. One was an analytical method based on high-order Ritz functions for accurate representation of steep strain gradients. The second was a conventional finite element approach using very fine meshes, and the third was a finite-element-based computation of energy release rates suitable for predicting crack growth. Among other interesting results, the analyses compared the effects of applied loads with the effects of actuation strains and found that the applied loads were more likely to cause cracking or delamination than actuation

**DESCRIPTORS:** (U) \*AEROSPACE CRAFT, \*COMPOSITE MATERIALS, \*LAMINATES, RELIABILITY, CRACKING(FRACTURING), LIFE EXPECTANCY(SERVICE LIFE), STRUCTURAL RESPONSE, MICROSTRUCTURE, INTERACTIONS, ACTUATORS, STRAIN(MECHANICS)

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EMBEDDING, FAILURE(MECHANICS), DISPLACEMENT, AXIAL  
LOADS, DELAMINATION, POLYMERS, MATRIX MATERIALS, CERAMIC  
MATERIALS, LOADS(FORCES).

IDENTIFIERS: (U) WUAFOSR2302DS, PE61102F, Smart  
materials, Ritz functions, Structural integrity, SBIR

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CALIFORNIA UNIV LOS ANGELES OFFICE OF CONTRACTS AND  
GRANTS ADMINISTRATION

(U) Dynamic Constraint Networks.

DESCRIPTIVE NOTE: Final rept. 1 Jan 90-30 Sep 93,

FEB 94 8P

PERSONAL AUTHORS: Pearl, Judea

CONTRACT NO. AFOSR-90-0136

PROJECT NO. 2304

TASK NO. A2

MONITOR: AFOSR, XC  
TR-94-0171, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The primary objective of this project has been the development of systems that reason in dynamic and open-ended environment and that use networks as their primary representation language. The focus of our research has been temporal reasoning, neural networks, truth maintenance, and default reasoning. This investigation has led to several basic results: the expressiveness of constraint networks was analyzed, tractable classes of constraint satisfaction problems were identified and effective processing techniques were developed.

DESCRIPTORS: (U) \*DYNAMICS, \*REASONING, \*NEURAL NETS,  
\*NETWORKS, MAINTENANCE, ALGORITHMS.

IDENTIFIERS: (U) WUAFOSR2304A2, PE61102F, Neural  
networks

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MICHIGAN UNIV ANN ARBOR GAS DYNAMICS LABS

(U) Scalar Imaging Velocimetry Studies of Turbulent Flow Structure and Dynamics.

DESCRIPTIVE NOTE: Final rept. 1 Oct 91-30 Sep 93,

DEC 93 76P

PERSONAL AUTHORS: Dahm, Werner J.

CONTRACT NO. F49620-92-J-0025

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0184, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) The first fully-resolved, non-intrusive, experimental measurements of the spatio-temporal structure and dynamics of the full nine-component velocity gradient tensor field  $\nabla u(x,t)$  in a turbulent flow are here obtained by applying the scalar imaging velocimetry technique (Phys. Fluids A 4, 2191-2208) to laboratory turbulent flow scalar field data. A variational method implementing this concept is described in which weighted residuals of the conserved scalar transport equation, the continuity condition, and a derivative smoothness condition are minimized over the space of velocity fields. The technique is applied to direct numerical simulation (DNS) data for the limiting case of turbulent mixing of a  $Sc = 1$  passive scalar field. The spatial-velocity fields  $u(x,t)$  obtained correlate well with the exact DNS results, as do statistics of the velocity and velocity gradient fields. The method is then applied to fully resolved four-dimensional  $Sc \gg 1$  scalar field imaging measurements from a laboratory turbulent time-varying  $(u, v, w)$  vector velocity component fields simultaneously everywhere on a regular three-dimensional spatial grid in a turbulent flow. Direct differentiation of these fields yields the spatial structure in the full velocity gradient tensor field components. From these, the vector vorticity field  $wl(x,t)$  and tensor strain rate

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field  $\epsilon_{ij}(x,t)$  are extracted, as are the kinetic energy density field  $k(x,t)$ , the kinetic energy dissipation rate field  $\phi(x,t)$ , and the enstrophy field  $w(x,t)$ . Finally, extraction of the time evolution in these fields is demonstrated by applying this scalar imaging velocimetry method to perform the inversion for the velocity field at several sequential time steps.

**DESCRIPTORS:** (U) \*TURBULENT FLOW, \*VELOCIMETERS, BOLTZMANN EQUATION, CONTINUITY, DENSITY, DISSIPATION, DYNAMICS, ENERGY, EXTRACTION, FLUIDS, FOUR DIMENSIONAL, GRADIENTS, GRIDS, INVERSION, KINETIC ENERGY, KINETICS, MEASUREMENT, MIXING, RATES, RESIDUALS, SIMULATION, STATISTICS, STRAIN RATE, STRUCTURES, TENSORS, THREE DIMENSIONAL, TIME, TRANSPORT, TURBULENCE, VARIATIONAL METHODS, VELOCITY, YIELD.

**IDENTIFIERS:** (U) WUAFOSR2307BS, PE61102F.

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UNITED TECHNOLOGIES RESEARCH CENTER EAST HARTFORD CT

YALE UNIV NEW HAVEN CT DEPT OF NEUROSURGERY

(U) Advanced Material Processing for Integrated-Optic Frequency Doubling Systems.

(U) Cytochemical Organization of the Retino-Suprachiasmatic System.

DESCRIPTIVE NOTE: Final rept. 1 Feb 91-30 Nov 93,

DESCRIPTIVE NOTE: Annual rept. 15 May 92-14 May 93,

NOV 93 27P

MAR 94 9P

PERSONAL AUTHORS: Rubino, R. A.; Cullen, D. E.

PERSONAL AUTHORS: VAN DEN POL, Anthony N.

REPORT NO. UTRC-R94-970053-1

CONTRACT NO. AFOSR-90-0072

CONTRACT NO. F49620-91-C-0022

PROJECT NO. 2312

PROJECT NO. 2301

TASK NO. CS

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0237, AFOSR

MONITOR: AFOSR, XC  
TR-94-0225, AFOSR

UNCLASSIFIED REPORT

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ABSTRACT: (U) This purpose of this two year program has been to investigate novel materials processing techniques for the purpose of producing highly efficient, nonlinear waveguide frequency doublers compatible with the integration of compact semi-conductor sources. As yet, practical, direct conversion, semiconductor sources of blue-light, have still to be proven, thereby motivating the research of waveguide second-harmonic generation, (SHG).

DESCRIPTORS: (U) \*MATERIALS, \*PROCESSING, \*SECOND HARMONIC GENERATION, \*INTEGRATED SYSTEMS, \*OPTICS, BLUE(COLOR), CONVERSION, FREQUENCY, INTEGRATION, LIGHT, SEMICONDUCTORS, WAVEGUIDES, NONLINEAR SYSTEMS, LITHIUM, NIOBIUM, TANTALUM, OXIDES, CIRCUITS, COMPOSITE MATERIALS.

IDENTIFIERS: (U) WUAFOSR2301CS, \*Frequency doubling systems, QPM(Quasi-Phase Matching), Quasi-phase matching, Lithium niobate, Lithium tantalate

ABSTRACT: (U) In situ hybridization was used to study the ionotropic subtypes of the glutamate receptor in the rat hypothalamus, particularly in the suprachiasmatic nucleus. Widespread expression of AMPA, kainate, and NMDA receptor RNA was found in the hypothalamus. GluR1 and GluR2 were among the most strongly expressed of the non-NMDA ionotropic receptors. Other AMPA-preferring receptors, GluR3 and -R4, were also found, but to lesser extent. Scattered cells expressed the kainate-preferring receptors Glu-R5 and -R6. Little GluR7 was found in the hypothalamus. The N-methyl D-aspartate receptor, NMDAR1, was detected throughout the hypothalamus. In many regions of the hypothalamus, only scattered cells showed detectable expression of the glutamate receptor mRNA as detected by autoradiographic silver grains over neurons; unlabeled cells were mixed among labeled cells.

DESCRIPTORS: (U) \*NERVE CELLS, \*CALCIUM COMPOUNDS, \*GLUTAMINE, ADHESIVES, CELLS, HYBRIDIZATION, HYPOTHALAMUS, RATS, REGIONS, SILVER, RIBONUCLEIC ACIDS, LASERS, CIRCADIAN RHYTHMS, MEMBRANES(BIOLOGY).

IDENTIFIERS: (U) PE81102F, WUAFOSR2312CS, \*Retino suprachiasmatic system.

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF  
MECHANICAL ENGINEERING

LAYER, DECOMPOSITION, FILTRATION, INTERACTIONS,  
QUANTITATIVE ANALYSIS, REYNOLDS NUMBER, SIMULATION,  
TURBULENCE, WALLS, SHEAR FLOW, BOUNDARY LAYER FLOW,  
TURBULENT FLOW.

(U) The Structure of High Reynolds Number Turbulent  
Boundary Layers, Part A.

IDENTIFIERS: (U) PE61102F, WUAFOFSR2307BS, Wavelets, High  
Reynolds number

DESCRIPTIVE NOTE: Final technical rept. Dec 89-Dec 93,

FEB 94 17P

PERSONAL AUTHORS: Brasseur, James G.

CONTRACT NO. AFOSR-90-0113

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0207, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We provide a summary of our accomplishments under a three-year 'mini URI' program in collaboration with researchers at Yale and Princeton universities. Whereas the central theme of the program is high Reynolds number wall-bounded turbulence, studies at Penn State included (1) analysis of fundamental issues of scale interactions in high Reynolds number turbulence dynamics, (2) the use of the wavelet decomposition and generalized filtering techniques in describing the relationship between the Fourier-spectral description of scale and the physical-space description of structure, (3) direct numerical simulation of passive scalar sources in low Reynolds number turbulent boundary layers and analysis of scalar evolution in relationship to laboratory data, (4) the relationship between homogeneous turbulent shear flow and the inertial sublayer in high Reynolds number turbulent boundary layers, and (5) the development and application of sophisticated data analysis techniques which intimately combine graphical and quantitative analysis within a fully interactive 'Analytical Environment'. A brief summary of the accomplishments in each area of development is presented. Turbulence, Turbulent boundary layers, Shear flows.

DESCRIPTORS: (U) \*TURBULENT BOUNDARY LAYER, BOUNDARY

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FLORIDA UNIV GAINESVILLE DEPT OF PSYCHOLOGY

OHIO STATE UNIV COLUMBUS DEPT OF MATHEMATICS

(U) Complex Auditory Signals.

(U) Whiskered Tori for Integrable Pde's: Chaotic Behavior in Near Integrable Pde's.

DESCRIPTIVE NOTE: Annual technical rept. 1 Jan 93-31 Jan 94,

DESCRIPTIVE NOTE: Final rept.,

FEB 94

12P

NOV 94

3P

PERSONAL AUTHORS: Green, David M.

PERSONAL AUTHORS: Overman, Edward A., II; McLaughlin, David W.

CONTRACT NO. F49620-92-J-0139

CONTRACT NO. AFOSR-91-0230

PROJECT NO. 2313

MONITOR: AFOSR, XC

TR-94-0240, AFOSR

TASK NO. AS

MONITOR: AFOSR, XC

UNCLASSIFIED REPORT

TR-94-0213, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This progress report covers the period from January, 1993 to January, 1994. First, we list the papers published during the period. Next, we list the papers submitted for publication and the papers presented at scientific meetings. The personnel are then listed, and, finally we conclude with a brief discussion of the problem areas in which future research efforts will be concentrated. We feel that more research should be devoted to this topic. Not only is this research needed to understand the basic stimulus variables in more detail, but it is needed in order to apply this research to real-world situations. In most realistic situations, the change in the auditory spectrum occurs at different times and with different degrees of synchrony among the components of the complex. Psychoacoustics.

DESCRIPTORS: (U) \*PSYCHOACOUSTICS, DOCUMENTS, PERSONNEL, VARIABLES, AUDITORY SIGNALS, NEUROPHYSIOLOGY.

IDENTIFIERS: (U) PE61102F, WUAFOSR2313AS.

ABSTRACT: (U) This is the final report for a project studying the perturbed sine-Gordon partial differential equations and the nonlinear Schrodinger partial differential equations. We studied low-dimensional chaos in these dissipative partial differential equations, in order to understand the onset of chaos, the underlying geometry of the partial differential equations, and how the chaos is low-dimensional. Final report, Chaos, Homoclinic orbits, Near Integrable Partial Differential Equations.

DESCRIPTORS: (U) \*CHAOS, \*PERTURBATION THEORY, \*SCHRODINGER EQUATION, GEOMETRY, PARTIAL DIFFERENTIAL EQUATIONS, COHERENCE, NONLINEAR ANALYSIS, SOLUTIONS(GENERAL), FOUR DIMENSIONAL, NUMERICAL ANALYSIS.

IDENTIFIERS: (U) Inverse spectral transform, \*Homoclinic orbits, Sine Gordon equation

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UNIVERSITY OF SOUTHERN CALIFORNIA LOS ANGELES

(U) Studies of Optical Beam Phase Conjugation and Electromagnetic Scattering Process.

DESCRIPTIVE NOTE: Final technical rept. 1 Dec 90-30 Nov 93,

MAR 94 28P

PERSONAL AUTHORS: Hellwarth, Robert W.

CONTRACT NO. F49620-91-C-0018

PROJECT NO. 2301

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0234, AFOSR

propagation, Photorefractive effect.

DESCRIPTORS: (U) \*ELECTROMAGNETIC WAVE PROPAGATION, \*NONLINEAR OPTICS, ATTENUATION, BROADBAND, CHARGED PARTICLES, DRIFT, ELECTROMAGNETIC SCATTERING, ENERGY, HARMONICS, HIGH POWER, MEASUREMENT, MIXING, PARTICLES, PHASE, PHOTONS, PULSES, SCATTERING, VAPORS, VELOCITY, GRATINGS(SPECTRA), REFRACTION, LIGHT SCATTERING, OPTICAL IMAGES, FIGURE OF MERIT.

IDENTIFIERS: (U) WUAFOSR2301CS, Optical pulses, Optical beams, Carbon 60, Carbon 70, Photorefractive materials, Phase conjugation

# UNCLASSIFIED REPORT

ABSTRACT: (U) In this project we have performed both experimental and theoretical studies of optical beam phase-conjugation and of electromagnetic scattering and propagation with intense optical fields. During the reporting period we have: (1) demonstrated that atomic vapors require fewer photons to perform optical wave mixing than any other medium examined to date; (2) sowed theoretically that a one-joule broadband optical pulse, whose carrier wavelength is one micron, can impart nearly one GeV energy to a charged particle; (3) established the stringent experimental upper limits on the hyperpolarizabilities of C60 and C70 molecules in solution; (4) made the first direct time-of-flight measurements of the drift velocity of photoexcited carrier in any photorefractive insulator (n-type Bi12SiO20); (5) determined the difference between the complex polarizabilities of different trap levels in insulators; (6) made quantitative predictions and measurements of spatial harmonic content of photorefractive gratings; (7) developed and applied moving-grating diagnostic techniques to photoexcited carriers; (8) demonstrated an exception to the law of exponential attenuation of weak monochromatic optical beams in a homogeneous medium. Optical beam phase conjugation, Nonlinear effects, High power optical beam

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AD-A278 388 9/3 12/1 CONTINUED

MARYLAND UNIV COLLEGE PARK INST FOR PHYSICAL SCIENCE AND TECHNOLOGY

IDENTIFIERS: (U) Strong, Fields, Propagators, Basis set models, Cray YMP computers, Polynomial extrapolation, Polarized, WUAFOSR2301A4

(U) Coherent Processes in Atom in Strong Radiation Fields.

DESCRIPTIVE NOTE: Final rept. 1 Feb 91-30 Sep 93,

SEP 93 5P

PERSONAL AUTHORS: Clark, C. W.; McIlrath, T. J.

CONTRACT NO. AFOSR-91-0109

PROJECT NO. 2301

TASK NO. A4

MONITOR: AFOSR, XC  
TR-94-0215, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During this grant period work proceeded to study alternative methods of integrating the higher dimensional time-dependent partial differential equations that arise in the study of atoms interacting with intense laser radiation. Present methods use, for example, Taylor series propagators applied to finite-difference and basis set models. We have more recently developed modified propagators based on polynomial extrapolation, rational polynomial extrapolation (Buelisch-Stoer), and have prepared versions that can be effectively vectorized on Cray YMP computers, and in the case of polynomial extrapolation, parallelize on massively parallel computers. In addition, the stability and accuracy of the finite-difference models has been compared to those based on interpolatory splines. The main effort in this grant was directed toward developing numerical integrators for the Schroedinger equation describing the interaction on atoms with circularly polarized light

DESCRIPTORS: (U) \*ATOMS, \*RADIATION, \*COHERENCE, \*PARTIAL DIFFERENTIAL EQUATIONS, \*LASERS, \*SCHRODINGER EQUATION, ELECTRONS, TIME DEPENDENCE, TAYLORS SERIES, FINITE DIFFERENCE THEORY, COMPUTERS, PARALLEL PROCESSING, INTERACTIONS, LIGHT, WAVE EQUATIONS, PROPAGATION, POLYNOMIALS.

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ILLINOIS UNIV AT CHICAGO CIRCLE DEPT OF CIVIL ENGINEERING  
MECHANICS AND METALL URGY

(U) Fundamental Studies in Crack Initiation.

based on absolute reaction theories.

DESCRIPTORS: (U) \*CRACK PROPAGATION, \*DAMAGE, COMPARISON,  
CONFIGURATIONS, CORES, CRACKS, CRAZING, CYCLES, DAMPING,  
DEFORMATION, DENSITY, DISTRIBUTION, KINEMATICS, LENGTH,  
MODELS, MOMENT OF INERTIA, POLYMERS, PROPAGATION,  
TRANSFORMATIONS, TRANSLATIONS, VARIABLES,  
FRACTURE(MECHANICS), FATIGUE.

DESCRIPTIVE NOTE: Annual rept. 15 Sep 92-14 Sep 93,

OCT 93 38P

PERSONAL AUTHORS: Botsis, John

CONTRACT NO. F49620-92-J-0493

PROJECT NO. 2302

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0227, AFOSR

IDENTIFIERS: (U) WUAFOSR2302DS, \*Initiation, Amorphous,  
Linear, Stress concentrator

UNCLASSIFIED REPORT

ABSTRACT: (U) Mechanistic investigations of damage evolution before crack initiation in an amorphous polymer show that damage consists of a core of highly dense crazing and a peripheral less dense zone of crazing. Damage characterization is carried out at consecutive configurations of the damage zone. Analysis of the kinematics of damage at different times involves comparisons of the inertia moments of damage distributions. The results indicate that damage evolution between consecutive configurations can be approximated by a linear transformation of the space variables. Thus, the process of damage growth can be described by translation and deformation of the damage zone. The growth rates of the damage zone movements decrease until crack initiation. In all cases, the average densities exhibit a damping type behavior with the number of cycles. The crack initiates within a core zone immediately ahead of the stress concentrator. The experimental results suggest that damage density within the core zone is independent of the loading conditions considered herein. This value is approximately equal to the damage density around the crack tip during slow crack propagation. The crack length at initiation is found to increase exponentially with the stress level. A simple decaying exponential relationship relates the crack initiation times and the applied stress level. This result is consistent with the fracture models

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JOHNS HOPKINS UNIV BALTIMORE MD DEPT OF ELECTRICAL AND  
COMPUTER ENGINEERING

(U) Material Engineering of the Novel Semiconductor  
Structures.

DESCRIPTIVE NOTE: Final rept. 15 Feb 91-14 Feb 94,

FEB 94 8P

PERSONAL AUTHORS: Khurgin, Jacob

CONTRACT NO. AFOSR-91-0183

PROJECT NO. 2305

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0230, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Using photoluminescence (PL) excitation spectroscopy we measured trapping times and recombination times in stepped QW's and coupled QW's and related the results to the wavefunction/interface overlaps. Continuous wave PL excitation spectra of multiple narrow-stepped QW's at room temperature have been measured for the first time. It has been observed that PL intensity increases stronger than as a square of the excitation intensity, and we have attributed this phenomenon to the intricate blend of the radiative recombination between free carriers with the nonradiative recombination on the saturable interface traps. Using the CW PL data only we have managed to measure both the trapping efficiency and ratio between electron and hole radiative and nonradiative decay times. The result of this research were published in the two separate articles in the Applied Physics Letters 2,4,8 and presented at international conferences 11-13.

DESCRIPTORS: (U) \*PHOTOLUMINESCENCE, \*MATERIALS, \*ENGINEERING, \*SEMICONDUCTORS, \*STRUCTURES, CONTINUOUS WAVES, DECAY, EFFICIENCY, ELECTRONS, EXCITATION, INTENSITY, INTERFACES, MIXTURES, OVERLAP, PHYSICS, RATIOS, ROOM TEMPERATURE, SPECTRA, SPECTROSCOPY, TRAPS, QUANTUM WELLS, WAVE FUNCTIONS, RECOMBINATION REACTIONS.

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## DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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AD-A278 384 17/9 20/14

CITY UNIV OF NEW YORK

CITY UNIV OF NEW YORK GRADUATE SCHOOL AND UNIV CENTER

(U) A New Tool for Signal Processing.

(U) Applied Harmonic Analysis.

DESCRIPTIVE NOTE: Final rept. 1 Jul 92-31 Oct 93,

DESCRIPTIVE NOTE: Final rept. 1 Jan 89-31 Aug 93,

OCT 93 4P

AUG 93 4P

PERSONAL AUTHORS: Auslander, Louis

PERSONAL AUTHORS: Auslander, Louis

CONTRACT NO. F49620-92-J-0412

CONTRACT NO. F49620-89-C-0020

PROJECT NO. 2304

PROJECT NO. 6674

TASK NO. ES

TASK NO. 00

MONITOR: AFOSR, XC  
TR-94-0139, AFOSRMONITOR: AFOSR, XC  
TR-94-0140, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

ABSTRACT: (U) Recent work has continued to study applications of the Weil transform to radar signal processing and, in a parallel effort, to multi-access spread spectrum communications. The main thrust of the work is the relationship between the Weil transform of a waveform and the ambiguity surface of the wave-form. The study of this relationship has led to a fundamental observation: the cancellation properties of a waveform necessary for the creation of a thumbtack-like ambiguity surface may be viewed as arising from the pattern of zeros and non-trivial winding numbers of the Weil transform of the waveform. This point of view is explicated and used to reinterpret classical radar waveform design techniques, while also providing a new method for radar waveform design. Additionally, a new technique for modifying or 'shaping' waveforms has been developed. This consists of changing a wave-form by multiplying its Weil transform by doubly-periodic functions and taking the inverse Weil transform to produce a new signal.

DESCRIPTORS: (U) \*RADAR SIGNALS, \*SIGNAL PROCESSING, FUNCTIONS, PATTERNS, PERIODIC FUNCTIONS, RADAR, SPREAD SPECTRUM, SURFACES, WAVEFORMS, WORK.

IDENTIFIERS: (U) WUAFOSR2304ES, Weil transform

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UNCLASSIFIED

ABSTRACT: (U) Recent work by the CUNY group under the direction of Professor Louis Auslander has continued to study application of the Weil transform to radar signal processing and, in a parallel effort, to multi-access spread spectrum communications. The main thrust of the work is the relationship between the Weil transform of a waveform and the ambiguity surface of the wave-form. The study of this relationship has led to a fundamental observation: the cancellation properties of a waveform necessary for the creation of a thumbtack-like ambiguity surface may be viewed as arising from the pattern of zeros and the non-trivial winding numbers of the Weil transform of the waveform. This point of view is explicated and used to reinterpret classical radar waveform design techniques, while also providing a new method for radar waveform design. Additionally, a new technique for modifying or shaping waveforms has been developed. This consists of changing a waveform by multiplying its Weil transform by doubly-periodic functions and taking the inverse Weil transform to produce a new signal.

DESCRIPTORS: (U) \*RADAR SIGNALS, \*SPREAD SPECTRUM, \*WAVEFORMS, ACCESS, AMBIGUITY, CANCELLATION, OBSERVATION, PATTERNS, PERIODIC FUNCTIONS, RADAR, SIGNAL PROCESSING, SURFACES, THRUST, HARMONIC ANALYSIS, MULTIPLE ACCESS.

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IDENTIFIERS: (U) WUAFOSR667400, \*Well transform.

UNITED TECHNOLOGIES RESEARCH CENTER EAST HARTFORD CT

(U) Novel Precursor. Approached for CMC Derived by Polymer Pyrolysis.

DESCRIPTIVE NOTE: Final rept. 15 Dec 90-14 Dec 93,

FEB 94 56P

PERSONAL AUTHORS: Schmidt, Wayde R.

REPORT NO. R94-970051-3

CONTRACT NO. F49620-91-C-0017

MONITOR: AFOSR, XC  
TR-94-0198, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) A family of reactive endblocked poly(methylvinylsilane), PMVS, polymers was developed for fabricating fiber-reinforced silicon carbide ceramic matrix composites (CMCs). Control of reaction conditions was optimized to synthesize a baseline PMVS in multiple batches and sufficient quantity to examine modifications of the polymer chemistry during processing and pyrolysis. The conversion of PMVS to carbon-rich nanocrystalline silicon carbide ceramic was studied using a variety of analytical techniques, including thermal analysis, infrared and nuclear magnetic resonance spectroscopy, X-ray diffraction, and electron microscopy. The excess C in PMVS ceramic chars was effectively scavenged with an added Si source. Perhydropoly(silazane), PHPS, provided a polymer precursor source of Si<sub>3</sub>N<sub>4</sub> and excess Si. Blends of PHPS and PMVS had higher char yields (70-85%) than either component polymer and generated novel nanocrystalline ceramics with heating to 1600 deg C. Crystal growth was inhibited in chars derived from these blends. Added elemental Si reacted with the excess C and enhanced crystal growth of SiC above the melting point of Si. Representative CMCs with good mechanical properties were fabricated using several PMVS-based matrix sources. The CMCs showed load vs. deflection curves typical of non-brittle failure and tensile specimens showed fibrous failure. Ceramic composites, Poly(methylvinylsilane), Polymer precursor, PHPS/PMVS Polymer blends.

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DTIC REPORT BIBLIOGRAPHY

SEARCH CONTROL NO. T4P42J

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DESCRIPTORS: (U) \*CERAMIC MATRIX COMPOSITES, \*POLYMERS, \*PRECURSORS, \*PYROLYSIS, CARBON, CONVERSION, CRYSTAL GROWTH, DEFLECTION, ELECTRON MICROSCOPY, ELECTRONS, FAILURE, FIBERS, HEATING, MAGNETIC RESONANCE, MECHANICAL PROPERTIES, MELTING POINT, MIXTURES, MODIFICATION, NUCLEAR MAGNETIC RESONANCE, PROCESSING, QUANTITY, SILICON CARBIDES, SPECTROSCOPY, THERMAL ANALYSIS, YIELD, FIBER REINFORCED COMPOSITES, INFRARED SPECTROSCOPY, X RAY DIFFRACTION.

IDENTIFIERS: (U) Poly(Methylvinylsilane), PMVS, Perhydropoly, Silazane

AD-A278 382 20/5 7/4 4/1

NORTH CAROLINA CENTRAL UNIV DURHAM

(U) High Resolution Molecular Spectroscopy of Atmospheric Species.

DESCRIPTIVE NOTE: Final rept. 1 Jul 89-30 Sep 93,

FEB 94 1SP

PERSONAL AUTHORS: Dutta, Jyotsna M.; Jones, Charles R.

CONTRACT NO. F49620-89-C-0080

PROJECT NO. 2310

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0184, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Laboratory-based pressure-broadening data has long provided information that is both of practical importance for technological applications and of fundamental interest for understanding molecular interactions and dynamics. During this project period the temperature dependence of the collision-broadened line widths of H<sub>2</sub>O and HDO were studied between 100 K and 600 K. Selected transitions were between 250 GHz and 500 GHz and the broadening gases were O<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>, and He. Low temperature measurements were made in a collisionally cooled cell to circumvent the limitations imposed by the low vapor pressure of the sample gas at temperatures far below their freezing points. The experimentally determined values were compared with earlier experimental and theoretical works.

DESCRIPTORS: (U) \*COLLISIONS, \*HIGH RESOLUTION, \*MOLECULAR SPECTROSCOPY, \*ATMOSPHERICS, \*WATER, DYNAMICS, FREEZING, INTERACTIONS, LOW TEMPERATURE, MEASUREMENT, PRESSURE, TRANSITIONS, VAPOR PRESSURE, WIDTH, REPRINTS, GASES, OXYGEN, NITROGEN, HYDROGEN, HELIUM, EARTH ATMOSPHERE.

IDENTIFIERS: (U) WUAFDSR2310AS, PE61102F, Species, \*Pressure broadening, HDO, Temperature dependence.

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GUMBS ASSOCIATES INC EAST BRUNSWICK NJ AD-A278 381 CONTINUED  
batteries

(U) Novel Sol-Gel Deposition for Repair of Conducting  
Paths in Polyceramic Systems.

DESCRIPTIVE NOTE: Final rept. 1 Jul-31 Dec 93,

FEB 94 32P

PERSONAL AUTHORS: Jang, Guang-Way

CONTRACT NO. F49620-93-C-0048

MONITOR: AFOSR, XC  
TR-94-0187, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The present project involves research and development of conducting polymer sol-gel composites for repair of conducting paths in polyceramic systems. During Phase I, we developed and carried out the synthesis of processible conducting polymers and organic/inorganic hybrid sol-gel materials. Sol-gel composite materials prepared during Phase I have high electrical conductivity (ca. 30 S/cm) and adhere strongly on the surface of ceramic materials. The conductivity of ITO glass was the same as its original value after repairing a crack with these sol-gel composites. Conductive sol-gel composites can be prepared with a very small amount of processible conducting polymers, ca. 3%. Composites with high concentration of conducting polymers (70% - 90%), however, showed better stability. Sol-gel metal oxides and conducting polymers are also ideal electrode materials for the fabrication of multilayer capacitors and rechargeable batteries. Upon completion of the present work, it is evident that the feasibility of the technology proposed for repairing conducting paths in polyceramic systems was demonstrated.

DESCRIPTORS: (U) \*CERAMIC MATERIALS, \*CONDUCTIVITY, \*ELECTRICAL CONDUCTIVITY, \*POLYMERS, \*REPAIR, \*DEPOSITION, CAPACITORS, COMPOSITE MATERIALS, CRACKS, ELECTRODES, FABRICATION, GLASS, MATERIALS, METALS, OXIDES, PHASE, STABILITY, SURFACES, SYNTHESIS, ORGANIC MATERIALS, INORGANIC MATERIALS, LAYERS.

IDENTIFIERS: (U) \*Sol gel process, Rechargeable

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A278 380 CONTINUED

ELECTRONIC MATERIALS ENGINEERING CAMARILLO CA

(U) Dynamics of Supermatrix Semiconductor Growth.

DESCRIPTIVE NOTE: Final rept. 25 Sep 90-24 Dec 93,

DEC 93 34P

PERSONAL AUTHORS: Holmes, Douglas E.; Koo, Linda

CONTRACT NO. F49620-90-C-0087

PROJECT NO. 2305

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0185, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) Electronic Materials Engineering and AFOSR have demonstrated a new semiconductor materials technology for electronic and optoelectronic device applications: the Supermatrix Semiconductor (SMS). SMS makes possible the 3-dimensional superlattice and a new method for engineering the properties of semiconductor materials through the synergy of 3-dimensional microstructural ordering. A CrGaAs SMS has been produced in Ingot form (2 in. long and 1 in. diameter) exhibiting a periodic rod-matrix microstructure over wafer-scale distances. Electronic, optical, and structural properties were characterized by PPL, SIMS, RBS, Auger, and x-ray diffraction and correlated to conditions of solidification. It was demonstrated that the cubic degeneracy of GaAs in the CrGaAs matrix is lifted as a result of anisotropic stress and leads to birefringence. Advances in practical processing of SMS materials, including polishing, have also been achieved to support future device development activities. Supermatrix semiconductor.

**DESCRIPTORS:** (U) \*SEMICONDUCTORS, \*MATRIX MATERIALS, AUGERS, BIREFRINGENCE, DIAMETERS, DIFFRACTION, ELECTRONICS, ENGINEERING, GALLIUM ARSENIDES, MATERIALS, MICROSTRUCTURE, POLISHING, PROCESSING, RODS, SCALE, SOLIDIFICATION, STRUCTURAL PROPERTIES, SUPERLATTICES, WAFERS, X RAY DIFFRACTION, X RAYS, DYNAMICS.

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ILLINOIS UNIV CHAMPAIGN

MEASUREMENT, MOTION, PARTICLE SIZE, PARTICLES, RATIOS, REAL TIME, RESOLUTION, STRATEGY, SUPPRESSION, TEMPERATURE, THREE DIMENSIONAL, TIME, TURBULENT FLOW, TWO DIMENSIONAL, VELOCITY, VORTEX SHEDDING, WORK, COMPUTERIZED SIMULATION.

(U) Real-Time Adaptive Control of Mixing in a Plane Shear Layer.

DESCRIPTIVE NOTE: Final rept. 15 Jan 90-14 Jul 93,

IDENTIFIERS: (U) WUAFOSR2307BS, PE81102F, \*Shear flow

FEB 94 66P

PERSONAL AUTHORS: Pearlstein, Arne J.

CONTRACT NO. AFOSR-90-0158

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0183, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Work was conducted on two projects related to real-time control of shear flows. In the first, two-dimensional unsteady simulations of the development of the wake behind a circular cylinder impulsively started into rotatory and rectilinear motion were performed. This simulation code is now serving as a testbed for the development of open- and closed-loop strategies for control of the lift/drag ratio as well as the suppression of vortex shedding. The code has been checked by comparison to earlier computational and experimental work. In the second project, a technique was developed to extract both velocity components in a two-dimensional incompressible flow from measurements of a single scalar (temperature or concentration), and all three velocity components in a three-dimensional incompressible flow from measurements of two scalars. The technique is applicable to steady or unsteady, laminar or turbulent flows. A key advantage over particle image velocimetry and other multi-point techniques is that our method uses full-field optical measurements, so that spatial resolution is not limited by particle size and loading restrictions.

DESCRIPTORS: (U) \*INCOMPRESSIBLE FLOW, \*WAKE, \*ADAPTIVE CONTROL SYSTEMS, \*SHEAR TESTS, \*TWO DIMENSIONAL FLOW, CIRCULAR, COMPARISON, DRAG, IMAGES, LIFT, LOOPS,

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AD-A278 378 3/2 20/3  
 CALIFORNIA INST OF TECH PASADENA SOLAR ASTRONOMY GROUP  
 (U) Large-Scale Velocity Fields and Small-Scale Magnetic  
 Fields During the Maximum of Solar Cycle 22.  
 DESCRIPTIVE NOTE: Final rept. 1 Oct 89-30 Sep 93,  
 FEB 94 45P  
 PERSONAL AUTHORS: Martin, Sara F.; Harvey, K. L.  
 CONTRACT NO. AFOSR-90-0008  
 PROJECT NO. 2311  
 TASK NO. AS  
 MONITOR: AFOSR, XC  
 TR-94-0176, AFOSR

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DESCRIPTORS: (U) \*SOLAR CYCLE, DISTRIBUTION, FILAMENTS,  
 HIGH LATITUDES, INVERSION, MAGNETIC FIELDS, OVERLAP,  
 POLARITY, SUNSPOTS, VARIATIONS, VELOCITY, SOLAR ACTIVITY,  
 LITHIUM NIOBATES, X RAYS, IRRADIATION, SUN.

IDENTIFIERS: (U) WUAFOSR2311AS, PE61102F, Size  
 distribution, Etalons

UNCLASSIFIED REPORT

ABSTRACT: (U) Studies of the solar cycle have revealed that the size distribution of active regions does not vary with the solar cycle. Size, rate of rise and lifetime of active regions are roughly proportional although a wide range of variation exists among these parameters. The polar field typically reverses about 2 years after solar maximum. The new solar cycle does not seem to start until after the reversal of the sign of the magnetic poles. However, the new solar cycle does overlap appreciably with the previous cycle and begins 3 or more years prior to the minimum in sunspot producing active regions. The solar cycle begins with ephemeral regions at high latitudes. From the analysis of active region and ephemeral region data over more than a whole solar cycle it is concluded that ephemeral regions are in all respects the small-scale end of the distribution of active regions. No rationale was found for excluding ephemeral regions as one of the effects of the solar dynamo. The search for the early ephemeral regions associated with solar cycle 23 at high latitudes yielded the tentative conclusion that it was detected during our observing runs during the spring of 1993 although confirming data is needed. Solar cycle, Small-scale magnetic fields, Large-scale velocity fields, Polarity inversion zones, Filaments.

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CALIFORNIA INST OF TECH PASADENA DEPT OF COMPUTER SCIENCE

PITTSBURGH UNIV PA DEPT OF ELECTRICAL ENGINEERING

(U) Program Composition.

(U) Wavelet Transforms in Parallel Image Processing.

DESCRIPTIVE NOTE: Final rept. 1 Nov 90-31 Oct 93,

DESCRIPTIVE NOTE: Final technical rept. 1 Jun 90-31 Jul 93,

JAN 94 6P

JAN 94 137P

PERSONAL AUTHORS: Chandy, K.

PERSONAL AUTHORS: Li, Ching-Chung; Hall, Richard W.

CONTRACT NO. AFOSR-91-0070

REPORT NO. TR-CV-93-07

PROJECT NO. 2304

CONTRACT NO. AFOSR-90-0310

TASK NO. A2

PROJECT NO. 9806

MONITOR: AFOSR, XC  
TR-94-0168, AFOSR

MONITOR: AFOSR, XC  
TR-94-0158, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

ABSTRACT: (U) Work done under this grant falls under four main areas: (1) Theory of Concurrent Systems - has led to much simpler ways of demonstrating the correctness of concurrent programs, (2) Use of Ada in Parallel Programming - exploring simple extensions of Ada that would make it suitable for shared-memory multiprocessor machines, (3) Parallel Paradigm Integration - researchers developed software and methods that help in developing large parallel applications incorporating both functional and data parallelism, (4) Language Development - this grant initiated work on PCN (Program Composition Notation), a very simple language for composing programs in Fortran and C; PCN has been ftp'd at over 300 sites, including Air Force Laboratories, and is being used at several universities for teaching parallel programming.

DESCRIPTORS: (U) \*ADA PROGRAMMING LANGUAGE, \*COMPUTER PROGRAMMING, \*PARALLEL PROCESSING, INTEGRATION, MULTIPROCESSORS, CONCURRENT ENGINEERING, SOFTWARE ENGINEERING.

IDENTIFIERS: (U) WJAFOSR2304A2, PE81102F, C Programming language, PCN(Program Composition Notation), C++ Programming language

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ABSTRACT: (U) This project consists of two parts: applications of wavelet transforms in multiscale image processing, and parallel algorithms and architectures. We have studied issues in wavelet-based edge detection: antisymmetry of wavelet filters and their support size with respect to edge localization, and a non-orthogonal four-coefficient wavelet edge detector. Texture segmentation using a modulated Daubechies wavelet has been studied, providing both spatial frequency and orientation selectivity. Object segmentation has been studied by examining silhouettes at multiple resolutions in piecewise linear approximations, and has been explored on LADAR data for use in target recognition. Applications to biomedical image compression, image halftoning and artificial neural network structure have also been investigated. In parallel processing, we have studied embeddings of wavelet transform algorithms as well as other algorithms for 2D and 3D mesh architectures and systolic arrays, and their time complexities have been evaluated. A variety of issues are addressed in utilization of 3D meshes in parallel image processing on 2D and 3D images including: the embedding of 2D images into 3D meshes, 3D shrinking incorporating subfields methodology, 3D connected component labeling, and

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segmentation in magnetic resonance imaging. Some fundamental issues for parallel reduction and reduction-augmentation operators in 2D and 3D image spaces have been examined.

DESCRIPTORS: (U) \*IMAGE PROCESSING, \*NEURAL NETS, \*PARALLEL PROCESSING, ALGORITHMS, ARRAYS, AUGMENTATION, COEFFICIENTS, COMPRESSION, DETECTION, DETECTORS, EDGES, EMBEDDING, FILTERS, FREQUENCY, GRAPHS, IMAGES, MAGNETIC RESONANCE, MESH, METHODOLOGY, PRESERVATION, PROCESSING, RESONANCE, SILHOUETTES, STRUCTURES, TARGET RECOGNITION, TARGETS, TEXTURE, TOPOLOGY, TWO DIMENSIONAL, THREE DIMENSIONAL, FOURIER TRANSFORMATION, RESOLUTION, PIXELS, COMPUTER GRAPHICS.

IDENTIFIERS: (U) WUAFOSR980600, Wavelets, LADAR(Laser Detection and Ranging), Laser detection

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25/3

TEXAS A AND M UNIV COLLEGE STATION DEPT OF ELECTRICAL ENGINEERING

(U) Spectral-Domain Optical Processing Techniques.

DESCRIPTIVE NOTE: Annual rept. 30 Sep 91-31 Mar 93,

APR 93 28P

PERSONAL AUTHORS: Taylor, Henry F.

CONTRACT NO. AFOSR-91-0417

PROJECT NO. 1601

TASK NO. 10

MONITOR: AFOSR, XC  
TR-94-0203, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Optical techniques for spectral domain processing (SDP) have been investigated. A computer model for the design of nonlinear devices for frequency mixing in multi-quantum well (MQW) materials has been developed. The model has been used to calculate nonlinear coefficients for mixing of pump lasers at wavelengths near 1.3um and 1.55 um to produce an output near 8.05um. A device length for conversion of 0.6 mm is predicted for a pump power density of 106W/cm<sup>2</sup>. A quasi-phase-matching scheme for obtaining high conversion efficiency in a dispersive semiconductor material has been devised. An N-dimensional hypercube network configuration making use of the frequency conversion devices has been proposed. The scheme allows for all-optical transmission of data from source node to destination node without optical-to-electrical conversion. Nonlinear optics communication networks, Quantum well.

DESCRIPTORS: (U) \*NONLINEAR OPTICS, \*OPTICAL COMMUNICATIONS, \*OPTICAL PROCESSING, CONVERSION, DENSITY, EFFICIENCY, FREQUENCY CONVERSION, LASERS, LENGTH, MATCHING, MIXING, MODELS, NETWORKS, NODES, OPTICS, OUTPUT, POWER, QUANTUM WELLS, SEMICONDUCTORS, COMPUTER PROGRAMS, LASER PUMPING, ALUMINUM GALLIUM ARSENIDES, GALLIUM ARSENIDES.

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NEW YORK UNIV NY DEPT OF PSYCHOLOGY

IDENTIFIERS: (U) PE61102F, WUAFOSR160110, Spectral  
domain

(U) Visual Motion Perception and Visual Information  
Processing.

DESCRIPTIVE NOTE: Final rept. 1 Feb 91-31 Dec 93,

DEC 93 161P

PERSONAL AUTHORS: Sperling, George

CONTRACT NO. AFOSR-91-0178

PROJECT NO. 2313

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0159, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This final progress report summarizes the main recent results; full reports of the results are contained in the papers appended herewith. The summary also reviews some results from previous AFOSR grants where these are necessary to provide the background for the current research. Four areas are summarized: (1) Basic Mechanisms of Visual Motion and Texture Perception; (2) Lateral Interactions in Texture Stimuli; (3) Information Processing; and (4) Visual Attention and Short-Term Memory.

DESCRIPTORS: (U) \*ATTENTION, \*MOTION, \*SPACE PERCEPTION, BACKGROUND, GRANTS, INFORMATION PROCESSING, PERCEPTION, PROCESSING, STIMULI, TEXTURE, CHANNELS, DETECTION, DOCUMENTS, FILTRATION, PATTERNS, VISUAL PERCEPTION, PATTERN RECOGNITION.

IDENTIFIERS: (U) PE61102F, WUAFOSR2313AS, \*Motion perception, \*Visual information processing.

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SYMBUS TECHNOLOGY INC BROOKLINE MA

(U) Workshop on Self-Determination in Developing and Evolving Systems.

DESCRIPTIVE NOTE: Final rept. 15 Dec 93-14 Jan 94,

FEB 94 63P

PERSONAL AUTHORS: Kuperstein, Michael

CONTRACT NO. F49620-94-C-0011

PROJECT NO. 2313

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0188, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) Self-determined systems are usually studied by researchers with unrelated terminology and few known common principles. This workshop was aimed at bringing together scientists whose research directly confronts the problems of analyzing, explaining and building self-determined systems. We hoped that sharing their results and interpretations at the meeting would inspire cross pollination of ideas from different viewpoints and lead to a more unified approach and language to understanding self-determination. The workshop format and discussions were aimed at discovering underlying principles while amplifying little known links between scientific fields. The emphasis was on discovering tools and mechanisms that have general application to research problems in biology, neuroscience, psychology and computer science. Fifteen researchers came together to explore these issues at Harvard University, January 8-9, 1994. Together, they brought their expertise from Biology, Neuroscience, Developmental Psychology and Computational Modeling.

**DESCRIPTORS:** (U) \*WORKSHOPS, \*SELF OPERATION, \*SYSTEMS ENGINEERING, APPROACH, BIOLOGY, COMPUTERS, DETERMINATION, DEVELOPMENTAL PSYCHOLOGY, FORMATS, LANGUAGE, PSYCHOLOGY, SCIENTISTS, SHARING, TOOLS, UNIVERSITIES, NEUROLOGY, BRAIN, EVOLUTION(DEVELOPMENT), SYSTEMS APPROACH, SYSTEMS

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ANALYSIS, COMPUTATIONS, MATHEMATICAL MODELS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2313BS, \*Self determined systems

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK

(U). Development of Predictive Reaction Models of Soot Formation.

DESCRIPTIVE NOTE: Final technical rept. 1 Jan 91-31 Dec 93,

FEB 94 30P

PERSONAL AUTHORS: Frenklach, Michael

CONTRACT NO. AFOSR-91-0129

PROJECT NO. 2308

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0186, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The ultimate objective of the present research program is to develop a predictive reaction model for soot formation in hydrocarbon flames. The principal accomplishments in the reported period are: (1) A computer algorithm was developed that calculates optical properties of an ensemble of particles whose size distribution is given in terms of moments of the size distribution function. (2) A computational study of sooting limits in laminar premixed flames was initiated and completed. It was found that the critical equivalence ratios for soot appearance, both the absolute values and temperature dependencies, can be predicted fairly close to the experimental observations. (3) New estimation techniques were developed and applied for calculations of standard-state enthalpies of formation and binary gaseous diffusion coefficients of polycyclic aromatic hydrocarbons (PAHs) and their radicals, thus providing critical information for accurate modeling of soot formation in flames. (4) Theoretical studies of a benchmark ion-molecule reaction were initiated and completed. The results obtained further support the neutral-species reaction pathway as the predominant route for the formation and growth of PAHs, the precursors to soot in hydrocarbon flames. (5) A computational study of pressure effect on soot formation was performed. (6) A reduced

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model for PAH and soot formation in turbulent reactive flows was developed. Soot formation, Reaction mechanisms, Modeling.

DESCRIPTORS: (U) \*FLAMES, \*HYDROCARBONS, \*MODELS, \*SOOT, ALGORITHMS, AROMATIC HYDROCARBONS, COEFFICIENTS, COMPUTERS, DIFFUSION, DISTRIBUTION FUNCTIONS, FUNCTIONS, IONS, MOLECULES, MOMENTS, NEUTRAL, OBSERVATION, OPTICAL PROPERTIES, PARTICLES, PRECURSORS, PRESSURE, RATIOS, STANDARDS, PREDICTIONS, ENTHALPY, GASES, ION MOLECULE INTERACTIONS, TURBULENT FLOW.

IDENTIFIERS: (U) PEB1102F, WUAFOSR2308BS, \*Formation, \*Predictive reaction models, Size distribution, Laminar premixed, PAH(Polycyclic Aromatic Hydrocarbon), Neutral species, RRKM Theory, Temperature dependence.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A278 365 17/1 CORNELL UNIV ITHACA NY DEPT OF ELECTRICAL ENGINEERING  
AD-A278 364 8/4 5/8 RUTGERS - THE STATE UNIV NEW BRUNSWICK NJ DEPT OF PSYCHOLOGY

(U) Multiparameter Bifurcations and Applications.  
DESCRIPTIVE NOTE: Final rept. 1 Dec 92-31 Aug 93.  
SEP 93 7P

AUG 93 5P  
PERSONAL AUTHORS: Steinhardt, Allan  
CONTRACT NO. F49620-93-1-0054  
PROJECT NO. 2304  
TASK NO. A2  
MONITOR: AFOSR, XC  
TR-94-0170, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) New test statistics for signal detection with a multi-sensor array were developed. Bin gating was employed to exploit diversity in estimating noise covariance matrix (nuisance parameter). Work was performed on calibration of ULA's, and invariant tests developed for the validation of optimal array configuration.

DESCRIPTORS: (U) \*ADAPTIVE FILTERS, \*ACOUSTIC DETECTION, \*SIGNAL PROCESSING, ARRAYS, CONFIGURATIONS, COVARIANCE, SIGNAL TO NOISE RATIO, STATISTICS, TEST AND EVALUATION, VALIDATION, MULTIVARIATE ANALYSIS, GAUSSIAN NOISE.

IDENTIFIERS: (U) WUAFOSR2304A2, ULA(Uniform Linear Array)

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UNCLASSIFIED REPORT

ABSTRACT: (U) When we look around a natural environment the eye is directed toward objects we select. We seem to do this task accurately and effortlessly. Yet, even such a simple task presents real problems for the oculomotor system, namely, to select the relevant target from the detailed background so that only information contained in it influences the line of sight and to spatially-pool information in the selected target so that the line of sight lands at a single position within the selected target. We have found that: (1) the saccadic target is designated by means of selective perceptual attention, which means people cannot prepare to look to one target while accurately perceiving targets elsewhere, and (2) there is a highly-accurate spatial pooling process which can direct the line of sight to precise positions within large targets. The results show that the oculomotor system is capable of extremely rapid and effective scanning. The procedures humans use to accomplish this task may prove useful for the guidance of robotic systems which need to move about in patterned visual environments.

DESCRIPTORS: (U) \*EYE MOVEMENTS, \*VISUAL PERCEPTION, ATTENTION, BACKGROUND, ENVIRONMENTS, EYE, GUIDANCE, HUMANS, LINE OF SIGHT, ROBOTICS, SCANNING, TARGETS, VISION.

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AD-A278 362 6/4 6/3 5/8

IDENTIFIERS: (U) \*Visual information processing

BOSTON UNIV MA

(U) Neural Models of Motion Perception.

DESCRIPTIVE NOTE: Annual technical rept. 1 Sep 92-31 Aug 93,

FEB 94 11P

PERSONAL AUTHORS: Grossberg, Stephen; Mingolla, Ennio

CONTRACT NO. F49620-92-J-0334

PROJECT NO. 3484

TASK NO. S4

MONITOR: AFOSR, XC  
TR-94-0142, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Eight research projects supported by this grant during the reporting period have resulted in three refereed publications, one under review, one book chapter, and three conference papers. Areas of research included design and simulation of neural architectures for: (1) multichannel data fusion; (2) object recognition and image understanding; (3) development and refinement of algorithms for segmentation, boundary completion, and featural filling-in based on BCS/FCS architectures; (4) network design and simulations of an architecture for breaking of unwanted persistence (hysteresis) of visual segmentations; (5) design of a network architecture for explaining human capabilities for efficient detection of targets in clutter; (6) design and execution of human psychophysical experiments for constraining development of the BCS; (7) design and simulation of a network architecture for enhancing featural contrast and boundary localization at line-ends and corners through a novel circuit analog of VI to lateral geniculate nucleus feedback; and (8) relation of hyperacuity and illusory contour data.

DESCRIPTORS: (U) \*MOTION, \*NEURAL NETS, \*VISUAL PERCEPTION, ALGORITHMS, ANALOGS, ARCHITECTURE, BOOKS, BOUNDARIES, CIRCUITS, CLUTTER, CONTOURS, CONTRAST, DATA FUSION, DETECTION, DOCUMENTS, FEEDBACK, FILLING, GRANTS,

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HUMANS, HYSTERESIS, IMAGES, MULTICHANNEL, NETWORKS, TEST  
RECOGNITION, SIMULATION, TARGETS, NEUROPHYSIOLOGY, TEST  
AND EVALUATION, OPTICAL IMAGES, MODELS.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484S4, Neural models,  
\*Motion perception, Visual segmentation

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QUANTEX CORP ROCKVILLE MD

(U) Hardware Implementation of Time Lenses and Ultrafast  
Optical Temporal Processors. Phase 1.

DESCRIPTIVE NOTE: Final rept. 1 Sep 93-28 Feb 94,

MAR 94 33P

PERSONAL AUTHORS: Yang, Xiangyang

CONTRACT NO. F49620-93-C-0062

PROJECT NO. 1602

TASK NO. 01

MONITOR: AFOSR, XC  
TR-94-0235, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The concept of time lens is based on the analogy between optical spatial diffraction and temporal dispersion. It extends our knowledge of optics in the space-domain into the time domain. Novel temporal imaging and signal processing systems can be created that mimic the operation of their spatial counterparts in the space-domain. A distinctive advantage of these temporal processing systems is their extremely high speed, up to picosecond range with currently available devices. In this Phase I program, we have studied the space-time duality and established a theoretical model for general temporal imaging systems. Design criteria for a phase chirp modulator as well as dispersive delay lines have been developed. Several temporal imaging and signal processing systems have been designed with commercially available optical and optoelectronic devices. Various applications of these temporal processing systems were studied. A temporal microscope and a temporal 4-f filtering system have been identified for prototype development in Phase II. Time lens, Optical temporal imaging and processing diffraction, Dispersion, Space-time Duality.

DESCRIPTORS: (U) \*IMAGE PROCESSING, \*OPTICAL PROCESSING,  
\*OPTICAL LENSES, DELAY LINES, DESIGN CRITERIA,  
DIFFRACTION, TIME DOMAIN, DISPERSIONS, FILTRATION,

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MICROSCOPES, MODELS, MODULATORS, OPTICS, PROTOTYPES,  
SIGNAL PROCESSING, OPTICAL IMAGES, COMPUTERS, SIGNALS,  
SYSTEMS ENGINEERING, VELOCITY, CHIRP FILTERS.

ARIZONA STATE UNIV TEMPE DEPT OF INDUSTRIAL AND  
MANAGEMENT SYSTEMS ENGINEERING

(U) Studies of the Effect of Image Degradation and  
Recombination.

IDENTIFIERS: (U) Optical computing, Spatial domain,  
Spatial light modulators, Space time.

DESCRIPTIVE NOTE: Annual rept. no. 2, 1 Mar 93-1 Mar 94,

MAR 94 7P

PERSONAL AUTHORS: Uttal, William R.

REPORT NO. PERLAB-3

CONTRACT NO. F49620-92-J-0176

PROJECT NO. 2313, 1123

TASK NO. AS, 00

MONITOR: AFOSR, XC  
TR-94-0221, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The second year of this grant has been very productive. We completed the major study that was underway last year and have moved on to complete two other major programmatic studies. The ongoing study that is now complete was the one in which we explored the effects of noise, Fourier filtering, reduced acuity (by means of blocking) and combinations thereof in a discrimination task. Ten experiments were carried out in this series. A publication on this work has been submitted for publication and is now being reviewed. From there we went on to consider the combination of degradations by the visual system rather than by means of the computer. In this study degraded images were combined with dichoptic viewing. A manuscript describing this work has also been submitted and is under review. We then undertook to study the effect of combinations of degradations on a recognition task. That work has also been completed and is in the process of being analyzed. The first paper submitted from our laboratory on the psychophysical foundations of night vision devices has been accepted for publication.

DESCRIPTORS: (U) \*DISCRIMINATION, \*IMAGES, \*NOISE,

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\*RECOMBINATION REACTIONS, ACUITY, BLOCKING, COMPUTERS, DEGRADATION, FILTRATION, NIGHT VISION DEVICES, RECOGNITION, VISION, PSYCHOPHYSICS, EYE.

IDENTIFIERS: (U) PE81102F, PE82205F, WUAFOSR2313AS, WUAFOSR112300, Fourier filtering, Dichoptic viewing

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CALIFORNIA INST OF TECH PASADENA DEPT OF APPLIED MATHEMATICS

(U) Differential Equations and Continuum Mechanics.

DESCRIPTIVE NOTE: Final technical rept. 1 Oct 90-30 Nov 93,

NOV 93 3P

PERSONAL AUTHORS: Cohen, Donald S.

CONTRACT NO. AFOSR-91-0045

PROJECT NO. 2304

TASK NO. A9

MONITOR: AFOSR, XC  
TR-94-0216, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The researchers were visited by Prof Christopher Durning from the Dept of Chemical Engineering at Columbia University. Prof Durning has an extensive background in experimenting with several kinds of anomalous polymers (including Case II materials). In almost daily seminars Prof Durning and Cohen, together with several of Cohen's grad students, formulated both a theoretical and experimental attack on problems arising in the strength and use of new materials and in problems from certain considerations in environmental chemistry. For example, new strong light weight materials for use in both commercial and military vehicles will have many non-planar shapes. Thus, these materials will sometimes be subject to compression (on the concave side of a bent sheet) and sometimes to tension (on the convex side.) Experiments yield greatly differing results in the two cases. The researchers need to incorporate the physics of these situations into their Case II diffusive model and accurately formulate the physics at the interfacial moving boundary. For the problems involving polymer films for use in protective clothing and uniforms and as separating membranes in environmental protective and clean-up devices, chemical effects often take place at the moving interface. The researchers have now formulated tractable models for many of these problems.

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DESCRIPTORS: (U) \*POLYMERS, \*DIFFUSIVITY, CHEMICAL  
ENGINEERING, COMPRESSION, FILMS, INTERFACES, MEMBRANES,  
MILITARY VEHICLES, PROTECTIVE CLOTHING, TENSION,  
TRANSPORT PROPERTIES, LIGHTWEIGHT, BOUNDARY VALUE  
PROBLEMS, CONTINUUM MECHANICS.

IDENTIFIERS: (U) WUAFOSR2304A9.

TENNESSEE UNIV KNOXVILLE CENTER FOR ENVIRONMENTAL  
BIOTECHNOLOGY

(U) Molecular Ecology of Bacterial Populations in  
Environmental Hazardous Chemical Control.

DESCRIPTIVE NOTE: Annual rept. 15 Jan 93-14 Jan 94,

JAN 94 10P

PERSONAL AUTHORS: Sayler, Gary S.

CONTRACT NO. F49620-92-J-0147

PROJECT NO. 2312

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0212, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The major outcomes of the current work are:

(1) Development of a new molecular strategy, mRNA  
extraction from soil, assesses the catabolic activity of  
soil bacteria in situ. (2) Quantitative the association  
between the biosensor bioluminescence response and the  
PAHs bioavailability present in the waste environment. (3)  
Demonstration the ability of NAH plasmid to mediate the  
initial biodegradation reactions in the catabolic pathway  
of fluorene. The current research work is focuses on  
developing new molecular diagnostics' method for  
measuring in situ PAH biodegradation activity and co-  
related the bioluminescence response, that produced by a  
naphthalene-lux reporter strain, to the bioavailability  
of different pollutants in the real environment. In  
addition, catabolism of a tricyclic aromatic hydrocarbon,  
fluorene, mediates by a NAH plasmid is also investigated.

DESCRIPTORS: (U) \*BACTERIA, \*PLASMIDS, \*SOILS, ADDITION,  
AROMATIC HYDROCARBONS, BIODETERIORATION, BIOLUMINESCENCE,  
CATABOLISM, DEMONSTRATIONS, ENVIRONMENTS, EXTRACTION,  
FLUORENES, HYDROCARBONS, NAPHTHALENES, ORGANIZATIONS,  
POLLUTANTS, RESPONSE, STRATEGY, WASTES, WORK, RIBONUCLEIC  
ACIDS, HAZARDOUS MATERIALS, TOXIC HAZARDS, MOLECULAR  
BIOLOGY.

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IDENTIFIERS: (U) PE81102F, WUAFOSR2312AS.

ARIZONA STATE UNIV TEMPE DEPT OF MECHANICAL AND  
AEROSPACE ENGINEERING

(U) Transition Receptivity and Control: Computations.

DESCRIPTIVE NOTE: Final technical rept. 15 Mar 90-30 Sep  
93,

MAR 94 50P

PERSONAL AUTHORS: Reed, Helen L.; Saric, William S.

CONTRACT NO. AFOSR-90-0234

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0185, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We modeled the receptivity of the laminar boundary layer on a semi-infinite flat plate with a modified-super-elliptic leading edge using a spatial direct numerical simulation. The incompressible flow was simulated by solving the governing full Navier-Stokes equations in general curvilinear coordinates by a finite-difference method. First, the steady basic-state solution was obtained in a transient approach using spatially varying time steps. Then, time-harmonic oscillations of the freestream streamwise velocity, modeling sound or spanwise vorticity, were applied as unsteady boundary conditions, and the governing equations were solved to evaluate the spatial and temporal developments of the perturbation leading to instability waves in the boundary layer. The effects of leading-edge radius and geometry on receptivity were determined. The work was closely coordinated with the experimental program. The computational work was also extended to solve the parabolized Navier-Stokes equations for the evolution of Gortler vortices in the presence of concave and convex curvature. Experiments were conducted on the receptivity of T-S waves to freestream sound in four different cases. (1) Two-dimensional roughness elements; (2) the interaction and control of T-S waves with 2-D roughness; (3) three-dimensional roughness elements; and (4) the

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leading edge. T-S wave amplitudes were measured as a function of freestream sound level and the roughness height for both 2-D and 3-D roughness elements.

DESCRIPTORS: (U) \*LAMINAR BOUNDARY LAYER, \*TRANSITIONS, \*MATHEMATICAL MODELS, \*FLAT PLATE MODELS, AMPLITUDE, BOUNDARIES, BOUNDARY LAYER TRANSITION, CONTROL, COORDINATES, CURVATURE, EDGES, ELLIPSES, FLOW, GEOMETRY, HARMONICS, HEIGHT, INCOMPRESSIBLE FLOW, INSTABILITY, INTERACTIONS, LAYERS, LEADING EDGES, NAVIER STOKES EQUATIONS, OSCILLATION, PERTURBATIONS, ROUGHNESS, SOUND, THREE DIMENSIONAL, TIME, TRANSIENTS, TURBULENCE, VELOCITY, VORTICES, COMPUTATIONS, FINITE DIFFERENCE THEORY, COMPUTERIZED SIMULATION.

IDENTIFIERS: (U) WUAFOSR2307BS.

GELTECH INC ALACHUA FL

(U) Silica Fresnel Lens for Laser Communications.

DESCRIPTIVE NOTE: Final technical rept. 1 Jul-31 Dec 93,

MAR 94 31P

PERSONAL AUTHORS: Zhu, Bing F.; Nogues, Jean-Luc

CONTRACT NO. F49620-93-C-0043

PROJECT NO. 1602

TASK NO. 01

MONITOR: AFOSR, XC  
TR-94-0154, AFOSR

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Original contains color plates: A11  
DTIC reproductions will be in black and white.

ABSTRACT: (U) This document presents the results of the study on the fabrication and characterization of pure silica Fresnel lenses by a replication process. To demonstrate the replication capability of diffractive or Fresnel optics, Fresnel lenses were prepared by a sol-gel molding technique. The optical quality and performance and dimensional characteristics of the lenses are reported. Optical and physical properties tested included glass homogeneity, UV/VIS/NIR transmission, light scattering and surface profilometry. Optical performance testing indicated that these glass Fresnel lenses are as good as their parent plastic Fresnel lenses. Success in this development is to open an avenue to many other applications where silica glass Fresnel lenses would be superior to plastics, both in optical quality and environmental stability. Fresnel lens, Silica glass, Sol-gel, Laser communication.

DESCRIPTORS: (U) \*FRESNEL LENSES, \*LASER COMMUNICATIONS, \*MOLDING TECHNIQUES, \*SILICA GLASS, FABRICATION, GELS, GLASS, HOMOGENEITY, LIGHT SCATTERING, OPTICS, PHYSICAL PROPERTIES, PLASTICS, QUALITY, STABILITY, SURFACES, OPTICAL PROPERTIES, TRANSFER FUNCTIONS, DIFFRACTION, MANUFACTURING.

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NIELSEN ENGINEERING AND RESEARCH INC MOUNTAIN VIEW CA

IDENTIFIERS: (U) WUAFOSR160201, WUAFOSR63218C, Sol-gels,  
Replication

(U) Controlling Combustion and Maximizing Heat Release in  
a Reacting Compressible Free Shear Layer.

DESCRIPTIVE NOTE: Final rept. 15 Dec 90-15 Dec 93,

FEB 94 38P

PERSONAL AUTHORS: Nixon, David; Keefe, Laurence R.

REPORT NO. NER1-TR-478

CONTRACT NO. F49620-91-C-0020

PROJECT NO. 2308

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0167, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The objective of this work has been to study the interaction between heat release and mixing in compressible shear layers by analysis and computation, with an eye to finding flow configurations that maximize the heat release per unit distance in the stream direction. The principal prediction is that heat release asymmetry across the layer can enhance mixing over the non-heat release case, but the effect appears too small to yield practical benefits at this time. Time dependent, three-dimensional numerical simulations of a shear layer with weak, steady heat release have shown that such heat release need not decrease mixing but the expected increases are also absent, or too small to be detected currently. However, the original non-heat-release theory has been successfully extended to predict the mixing behavior of three-dimensional planar layers and round compressible jets. This bolsters confidence in the generality of the principles underlying the analysis. Invoking a mixing maximum principle, the extended theory gives a satisfactory analytic expression for mixing ratio when  $M \text{ sub } c < \text{ or } = 3$ . A variational formulation of the heat release problem with a functional dependent on the square of streamline curvature has proved intractable. Shear layer, Compressibility, Mixing, Heat release.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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AD-A278 319 20/4

OLD DOMINION UNIV RESEARCH FOUNDATION NORFOLK VA

DESCRIPTORS: (U) \*HEAT TRANSFER, \*HYPERSONIC AIRCRAFT,  
\*AEROTHERMODYNAMICS, \*COMBUSTION, ASYMMETRY, COMPRESSIVE  
PROPERTIES, CONFIGURATIONS, CURVATURE, HEAT, INTERACTIONS,  
MIXING, SIMULATION, THREE DIMENSIONAL, SHEAR FLOW,  
ACOUSTIC VELOCITY, COMPRESSIBLE FLOW, MACH NUMBER,  
SPECIFIC HEAT.

(U) Reacting Compressible Mixing Layers: Structure and  
Stability.

DESCRIPTIVE NOTE: Final rept. 1 Jul 91-30 Jun 93,

OCT 93 54P

IDENTIFIERS: (U) PEG1102F, WUAFOSR2308BS, Speed of sound,  
Heat release

PERSONAL AUTHORS: Grosch, Chester

CONTRACT NO. AFOSR-91-0250

MONITOR: AFOSR, XC  
TR-94-0208, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The contract is in support of research on  
the structure and stability of reacting compressible  
mixing layers. The research performed under this contract  
has resulted in our learning a great deal about the  
structure and stability of reacting compressible mixing  
layers.

DESCRIPTORS: (U) \*STABILITY, \*COMPRESSIBLE FLOW, LAYERS,  
LEARNING, MIXING, STRUCTURES, SHEAR PROPERTIES.

IDENTIFIERS: (U) Scramjet engines.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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IDENTIFIERS: (U) PEB1102F, WUAFOSR2303BS, \*Nanoscale,  
\*Clusters, Terraces.

CORNELL UNIV ITHACA NY

(U) Mass Flow and Stability of Nanoscale Features on  
Au(III).

93 11P

PERSONAL AUTHORS: Cooper, B. H.; Peale, D. R.; McLean, J.  
G.; Phillips, R.; Chason, E.

CONTRACT NO. AFOSR-91-0137

PROJECT NO. 2303

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0149, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Materials Research Society Symp.  
Proc., v280 p37-46, 1993. Available only to DTIC users.  
No copies furnished by NTIS.

ABSTRACT: (U) We present the use of an STM to make  
quantitative observations of time-dependent mass flow  
associated with the decay of two-dimensional clusters on  
the Au(111) surface. When formed and observed in air,  
layered islands with well-defined edges located on larger  
terraces are generally found to decay in such a way that  
their areas decrease linearly in time over periods  
ranging from minutes to several hours depending on the  
island size. This is in contrast to the behavior of  
similar features formed and observed under ultra high  
vacuum conditions, which do not appear to decay over  
experimental periods of several days. The linear decay is  
consistent with models that have been used previously to  
describe growth of 2-dimensional clusters on surfaces. We  
discuss possible decay mechanisms, and the role that  
adsorbates may play in influencing the decay.

DESCRIPTORS: (U) \*DECAY, \*MASS FLOW, \*STABILITY, \*GOLD,  
\*ADSORBATES, AIR, EDGES, HIGH VACUUM, ISLANDS, MODELS,  
OBSERVATION, SURFACES, TIME, TWO DIMENSIONAL, REPRINTS,  
ULTRAHIGH VACUUM, ATOMIC STRUCTURE, METALS, FILMS,  
NUCLEATION.

## UNCLASSIFIED

DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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PENNSYLVANIA UNIV PHILADELPHIA

however, the flow stress of the two phase material exhibits a sharp decrease, a feature which is not observed in the single phase L12 materials and can be correlated with a continuous dissolution of the A12Ti precipitates at high temperatures.

94 9P

(U) L12 A13Ti-Based Alloys with A12Ti Precipitates-II.  
Deformation Behavior of Single Crystals,

PERSONAL AUTHORS: Pope, D. P.; Wu, Z. L.

DESCRIPTORS: (U) ABSTRACTS, ALLOYS, ANISOTROPY, AXES, BEHAVIOR, CLEAVAGE, DUCTILITY, ENERGY, FLOW, FUNCTIONS, HARDENING, HIGH TEMPERATURE, MATERIALS, PHASE, PRECIPITATES, SHAPE, TEMPERATURE, TRANSITIONS.

CONTRACT NO. F49620-92-J-0019

PROJECT NO. 2308

IDENTIFIERS: (U) PEG1102F, WUAFOSR2308AS, Slips, Octahedral, Cube systems.

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0179, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in Acta Metall. Mater., v42 n2 p519-526, 1994. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The operating slip systems and flow behavior of single crystalline Al66.8 Ti 27.4 Fe5.8 two phase L12 + A12 Ti material, was investigated as a function of temperatures using specimens with compressive axes near (011), (113), (112), (013) and (133). The material shows a very limited compressive ductility, and fracture occurs by cleavage along planes of low indices, such as (011), (001), (013) and (111). Slip occurs exclusively on the octahedral slip systems at low temperatures, and on both octahedral and cube systems at high temperatures. A transition in operating slip systems from octahedral slip to cube slip, similar to the one seen in Ni,Al-type alloys, occurs as the temperature increases and as the orientation of the specimens change from near-001 to near-111. The transition in slip system is attributed to the hardening effect of the A12Ti precipitates, rather than to the anisotropy of APB energy on cube and octahedral slip planes of the matrix. Because of the large hardening effect of the A12Ti, the two phase material is substantially stronger than single L12 phase materials. The shape (but not the level) of the flow stress-temperature curve for the two phase material resembles that of the single phase L12 material at low and intermediate temperatures. At high temperatures,

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KANSAS STATE UNIV MANHATTAN

\*HYDROGEN, \*NITROGEN, \*FLUORINE, \*CHLORIDES, ATOMS, CHANNELS, CONSTANTS, DISTRIBUTION, DYNAMICS, ELIMINATION, ELIMINATION REACTIONS, FLOW, MOLECULES, NUMBERS, RATES, SECONDARY, REPRINTS, HALOGENATED HYDROCARBONS, CHEMICAL REACTIONS, VIBRATION, HYDROGEN, THERMOCHEMISTRY, CHEMICAL RADICALS.

94 9P

PERSONAL AUTHORS: Arunan, E.; Liu, C. P.; Setser, D. W.; Gilbert, J. V.; Coombe, R. D.

IDENTIFIERS: (U) PE83218C, WJAFDSR180108, Fast flow reactors, Inverted, Unimolecular process.

CONTRACT NO. F49620-92-J-0275

PROJECT NO. 1601

TASK NO. 08

MONITOR: AFOSR, XC  
TR-94-0141, AFOSR

## UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Physical Chemistry, v98 n2 p494-501, 1994. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The primary and secondary reactions in the H + NfCl<sub>2</sub> system have been studied by infrared chemiluminescence in a fast flow reactor at 300 K. The primary reaction is exclusively Cl atom abstraction to give HCl(v=0-4) + NfCl with a total rate constant of  $(1.9 \pm 0.4) \times 10^{10} \text{ (exp -11) / cu cm molecule (exp -1) s (exp -1)}$  and an inverted vibrational distribution of p sub 0-p sub 4 = 9:20:32:27:12. The rate constant for HF formation from H + NfCl was estimated as  $(0.9 \pm 0.4) \times 10^{10} \text{ (exp -11) cu cm molecule (exp -1) s (exp -1)}$ , and the HF vibrational distribution, p sub 0 - p sub 3 = 42:34:18:6, is characteristic of unimolecular HF elimination reactions. These data for the HF + NfCl(a) product channel from the H + NfCl reaction are compared to earlier studies, which provided information about the HCl + Nf(a) product channel. The latter seems to be the more important, and the total rate constant for H + NfCl is about  $4 \times 10^{10} \text{ (exp -11) cu cm molecule (exp -1) s (exp -1)}$  at 300 K. The dynamics of the H + NfCl reaction are discussed and compared to the H + Nf<sub>2</sub> reaction. A small number of experiments also were done with the H + Nf<sub>2</sub>Cl reaction system.

DESCRIPTORS: (U) \*CHEMILUMINESCENCE, \*INFRARED SPECTRA,

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PENNSYLVANIA UNIV PHILADELPHIA

CALIFORNIA UNIV LOS ANGELES DEPT OF MATERIALS SCIENCE AND ENGINEERING

(U) Thermally Activated Unpinning of Screw Dislocations in the Anomalous Regime in L12 Compounds,

(U) Ultrastructure Processing of Advanced Materials.

DESCRIPTIVE NOTE: Final technical rept. 1 Dec 90-30 Nov 93,

PERSONAL AUTHORS: Khantha, M.; Cserti, J.; Vitek, V.

JAN 94 27P

CONTRACT NO. F49820-92-J-0019, \$AFOSR-89-0082

PERSONAL AUTHORS: Mackenzie, John D.

PROJECT NO. 2308

CONTRACT NO. AFOSR-91-0098

TASK NO. AS

PROJECT NO. 2303

MONITOR: AFOSR, XC

TR-94-0181, AFOSR

TASK NO. BS

UNCLASSIFIED REPORT

MONITOR: AFOSR, XC  
TR-94-0197, AFOSR

Availability: Pub. in Materials Research Society Symp. Proc., v288 p417-422, 1993. Available only to DTIC users. No copies furnished by NTIS.

UNCLASSIFIED REPORT

ABSTRACT: (U) We present a model for the anomalous increase of the yield stress exhibited by many L12 compounds. It is based on two thermally activated processes that describe respectively the pinning and unpinning of (101) screw dislocations in the (111) plane. The model explains all the important characteristic features observed in the anomalous regime. We discuss the applications of the model to Ni3Ga and Ni3(Al,Ta).

DESCRIPTORS: (U) \*DISLOCATIONS, \*SCREWS, MODELS, YIELD, REPRINTS, ACTIVATION, ENTHALPY, NICKEL, ALUMINUM, GALLIUM, TANTALUM, TENSION, COMPRESSION, THERMAL ANALYSIS, ALLOYS, THERMOCHEMISTRY, HIGH TEMPERATURE, INTERMETALLIC COMPOUNDS, THERMODYNAMICS.

IDENTIFIERS: (U) PE81102F, WUAFOSR2308AS, \*Unpinning, Anomalous regime, L12 Compounds

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ABSTRACT: (U) This Final Technical Report covering the three-year period from December 1, 1990 to November 30, 1993 presents a summary of research performed on two classes of materials obtained by the sol-gel method. Single crystal thin films were successfully prepared for the, ferroelectric materials KNbO3 and LiNbO3. A new phenomenon, Amorphous Ferroelectricity was discovered. Organically Modified Silicates (Ormosils) were further developed to give enhanced high temperature rubbery elasticity. A theory was developed for the calculation of the hardness of Ormosils. By modifying the Ormosils with Ti, Zr and Al to replace Si, Vickers Hardness of over 200 Kg/sq mm 2 was obtained. This is about ten times that of the hardness of the hardest transparent organic plastics. Sol-Gel Science, Ferroelectrics, Organically modified ceramics.

DESCRIPTORS: (U) \*FERROELECTRIC MATERIALS, \*SINGLE CRYSTALS, \*THIN FILMS, COVERINGS, FERROELECTRICITY, HARDNESS, HIGH TEMPERATURE, PLASTICS, SILICATES, SILICON, TEMPERATURE, COMPOSITE MATERIALS, LITHIUM, POTASSIUM, NIOBIUM, OXIDES, ORGANIC MATERIALS, MODIFICATION, ELASTIC PROPERTIES, CERAMIC MATERIALS, TITANIUM, ZIRCONIUM, ALUMINUM.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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IDENTIFIERS: (U) PE61102F, WUAFOSR2303BS, Sol-gel process, Ormosils (Organically Modified Silicates), Ultrastructures processing.

AD-A278 283 11/2 8/7 20/11  
NORTHWESTERN UNIV EVANSTON IL TECHNOLOGICAL INST  
(U) Nonlocal Theory for Fracturing of Quasibrittle Materials.

DESCRIPTIVE NOTE: Final rept.,

MAR 94 220P

PERSONAL AUTHORS: Bazant, Zdenek P.

REPORT NO. 0850-350-0457

CONTRACT NO. AFOSR-91-0140

MONITOR: AFOSR, XC  
TR-94-0204, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The failure of quasibrittle materials, which include concrete, rock, high-performance ceramics and fiber composites, cannot be treated according to the classical theories of plasticity or fracture mechanics because growth of zones of strain softening damage due to cracking must be considered. The mathematical treatment involves difficulties with spurious excessive localization. To remedy them, the nonlocal continuum concept was previously introduced, however, without theoretical foundation. The principal objective of the research has been to formulate the nonlocal damage concept on the basis of micromechanics of systems of growing and interacting cracks. This has led to a new model in which the nonlocal interactions are based on a smeared crack influence function, are tensorial and directional, and directional, and exhibit a power-type long-range decay. An iterative method for solving a Fredholm integral equation for the crack interactions in a finite element code has also been formulated. Advances have further been made in several related problems of micro-macro correlation. The applicability limits of the classical Weibull theory of random micro-strength have been identified and a nonlocal probabilistic generalization derived. The time dependence and rate effect in damage evolution have been described on the basis of the activation theory for bond ruptures. The problems of scaling and size effect associated with damage have been analyzed, both theoretically and

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DTIC REPORT BIBLIOGRAPHY

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experimentally (with tests on concretes, fiber composites and rocks).

DESCRIPTORS: (U) \*CONCRETE, \*ROCK, \*BRITTLENESS, \*CRACKING(FRACTURING), \*CERAMIC MATERIALS, MICROMECHANICS, INTEGRAL EQUATIONS, ITERATIONS, FINITE ELEMENT ANALYSIS.

IDENTIFIERS: (U) \*Fiber composites, Fredholm equation.

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XEROX PALO ALTO RESEARCH CENTER CA

(U) The Use of Selective Area Growth for the Reduction of Threading Dislocation Densities in Heteroepitaxy.

DESCRIPTIVE NOTE: Final rept.,

MAR 94 110P

PERSONAL AUTHORS: Biegeisen, D. K.; Bringans, R. D.

CONTRACT NO. F49620-91-C-0081

PROJECT NO. 2305

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0229, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The central goal of this project has been the achievement of low defect density GaAs heteroepitaxy on Si by growing mesas with free side walls. Several approaches were used singly and in combination in attempts to guide misfit dislocations (MDs) to the GaAs mesa edges and minimize threading dislocation (TD) densities. Methods included the use of Si pedestals with concave sidewalls, interposed plastically-soft ZnSe buffer layers, graded-composition InGaAs strained layers and post deposition anneals of the various structures. It was found that, surprisingly, TD densities are hardly reduced by the presence of free sidewalls. Moreover, dislocation interactions during the early stages of growth determined the structure and density of TDs in as-grown films and not thermal mismatch strain during cool down from the growth temperature. It was found that graded-strain layers led to a reduction of dislocation densities by a factor of approximately 15 in films grown over pedestals with convex (111) faceted sidewalls. It was concluded that to obtain minimum TD densities it is imperative to prevent formation of 90 deg MDs during lattice mismatched heteroepitaxial growth. The structure and thermal stability of interfaces between ZnSe and Si: As(100) were also determined. The observed asymmetric organization of dislocations was shown to arise from the formation and propagation of misfit dislocations on

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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Vicinal surfaces. Heteroepitaxy. Selective area growth, GaAs on Si

DESCRIPTORS: (U) \*DENSITY, \*DISLOCATIONS, \*GALLIUM ARSENIDES, \*REDUCTION, APPROACH, BUFFERS, DEPOSITION, EDGES, FILMS, INTERACTIONS, INTERFACES, LAYERS, ORGANIZATIONS, PROPAGATION, SILICON, STABILITY, STRUCTURES, SURFACES, TEMPERATURE, THERMAL STABILITY, WALLS, EPITAXIAL GROWTH, ZINC, SELENIDES, INDIUM, ANNEALING.

IDENTIFIERS: (U) WUAFOSR2305BS, \*Selective area growth, \*Threading, \*Heteroepitaxy, Low defect, Mesas, Free side walls, Concave, \*Mismatch

AD-A278 281 9/1

NEW MEXICO UNIV ALBUQUERQUE DEPT OF ELECTRICAL ENGINEERING AND COMPUTER SCIEN CE

(U) Repetitively Pulsed Backward-Wave Oscillator Investigations.

DESCRIPTIVE NOTE: Final rept.,

MAR 94 '113P

PERSONAL AUTHORS: Schamiloglu, Ed1

CONTRACT NO. F49620-92-J-0157

PROJECT NO. 2301

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0232, AFOSR

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

ABSTRACT: (U) The Pulsed Power and Plasma Science Laboratory at the University of New Mexico (UNM) has completed its initial phase of research on repetitively pulsed high power backward-wave oscillators (BWOs). The aggressive program that we had established sought to address three basic goals: (1) Understand the physics of high efficiency vacuum BWOs using the Sinus-6 repetitively pulsed electron beam accelerator, (2) study vacuum and initiate plasma-filled long pulse BWO operations using the modified PI-110A accelerator, and (3) Study the prospects of incorporating ferroelectric ceramic cathodes in high power electron beam-driven microwave sources to improve their operations in the long pulse regime

DESCRIPTORS: (U) \*BACKWARD WAVE OSCILLATORS, HIGH POWER, MICROWAVES, ELECTRON BEAMS, ELECTRON ACCELERATORS, HIGH VACUUM.

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OHIO STATE UNIV RESEARCH FOUNDATION COLUMBUS

STRUCTURES, TEXTURE, TRANSFORMATIONS, THREE DIMENSIONAL.  
IDENTIFIERS: (U) PEG1102F, WUAFOSR2313AS.

(U) Visual Perception of 3-Dimensional Structure from  
Different Types of Optical Deformation.

DESCRIPTIVE NOTE: Annual technical rept. 15 Feb 93-15 Feb  
94,

FEB 94 3P

PERSONAL AUTHORS: Todd, James T.

CONTRACT NO. F49620-93-1-0116

PROJECT NO. 2313

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0222, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The research performed by James Todd during the past year of AFOSR support has examined the abilities of human observers to determine an object's 3-dimensional form from various types of optical information such as shading, texture, motion or binocular disparity, both individually and in combination. The results of this research have provided strong evidence that 3-dimensional structure may be perceptually represented in a manner that is similar to the Klein hierarchy of geometries, such that observers are most sensitive to those aspects of an object's structure that remain invariant over the largest number of possible transformations. The evidence to support this hypothesis has been obtained using a wide variety of converging operations, including judgments of euclidean 3D length, judgments of conformational properties such as 3D angles, and judgments of affine properties such as planarity. We have also examined how these judgments are influenced by combining different types of optical information using both computer simulations and direct viewing of natural scenes.

DESCRIPTORS: (U) \*OPTICAL EQUIPMENT, \*VISUAL PERCEPTION, ANGLES, BINOCULARS, COMPUTERS, HIERARCHIES, HUMANS, LENGTH, MOTION, NUMBERS, OBSERVERS, OPERATION, SIMULATION,

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ARIZONA UNIV TUCSON OPTICAL SCIENCES CENTER

(U) Research in the Optical Sciences.

DESCRIPTIVE NOTE: Final technical rept.,

FEB 94 59P

PERSONAL AUTHORS: Powell, Robert C.

CONTRACT NO. F49620-91-C0009

PROJECT NO. 2301

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0238, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) This report discusses research progress in the optical sciences, including the areas of: Monte Carlo simulation of multiple quantum well infrared detectors; field-of-view micro-optics; optical elements for X-UV wavelengths; fundamental physics of MBE heterostructures; MBE growth of novel semiconductor heterostructures; optical nonlinearities in low-dimensional semiconductor structures; carrier relaxation studies in semiconductor lasers and in novel GaAs quantum-well structures; spectral hole burning and instabilities in semiconductor lasers; surface characterization of semiconductor structures; propagation of short optical pulses in passive and active nonlinear all-optical switches; and atom optics. Optical sciences.

**DESCRIPTORS:** (U) \*OPTICS, ATOMS, DETECTORS, GALLIUM ARSENIDES, INFRARED DETECTORS, LASERS, PHYSICS, PROPAGATION, PULSES, QUANTUM WELLS, RELAXATION, SEMICONDUCTOR LASERS, SEMICONDUCTORS, SIMULATION, STRUCTURES, SURFACES, SWITCHES, MONTE CARLO METHOD, MOLECULAR BEAMS, EPITAXIAL GROWTH, SHORT PULSES, NONLINEAR OPTICS, OPTICAL SWITCHING.

**IDENTIFIERS:** (U) PE61102F, WUAFOSR2301CS, Field-of-view, Carrier, Spectral hole burning, Ultraviolet

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YALE UNIV NEW HAVEN CT DEPT OF ELECTRICAL ENGINEERING  
(U) Adaptive Stabilization of Linear and Nonlinear Systems.

DESCRIPTIVE NOTE: Final rept. 1 Jan 92-31 Dec 93,

MAR 94 9P

PERSONAL AUTHORS: Morse, A. S.

CONTRACT NO. F49620-92-J-0077

PROJECT NO. 2304

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0239, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) With AFOSR support, a new strategy called 'cyclic switching' has been devised for dealing with the well-know, long standing, certainty equivalence control synthesis problem which arises in the design of identifier-based adaptive controllers because of the existence of points in the parameter space where the design model upon which certainty equivalence synthesis is based, loses stabilizability. The concept is provably correct, easily implemented, and applicable to both siso and mimo linear systems, whether they are minimum phase or not. The feasibility has been established of an entirely new method of supervisory control called 'dwell-time switching'. Dwell time switching is a simple on-line logic capable of determining in real time which controller from a family should be put in feedback with a process as to achieve satisfactory performance. The method is intended to be used in situations where there is substantial process model uncertainty, so much in fact that no single fixed parameter, linear control can possibly work.

**DESCRIPTORS:** (U) \*STABILIZATION SYSTEMS, \*ADAPTIVE CONTROL SYSTEMS, \*SWITCHING LOGIC, PARAMETERS, ALGORITHMS, FEEDBACK, AUTOMATIC GAIN CONTROL, INPUT OUTPUT MODELS.

**IDENTIFIERS:** (U) PE61102F, WUAFOSR2304AS, Cycle switching, Dwell time switching, Supervisory control,

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SISO(Single Input Single Output), MIMO(Multi Input Multi Output).

PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF MECHANICAL ENGINEERING

- (U) Turbulence Structure Associated with Intercomponent and Interscale Energy Transfer and Modification by Forcing.

DESCRIPTIVE NOTE: Final technical rept. 1 Nov 88-31 Oct 93,

DEC 93 11P

PERSONAL AUTHORS: Brasseur, James G.

CONTRACT NO. AFOSR-89-0026

PROJECT NO. 2307

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0208, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) There are two parts to this research program. First program focusses on the quantification of loosely held concepts such as 'structure,' and 'dynamic significance' of structure in the study of turbulent flows in general, and shear flows in particular. We have developed a robust algorithm which 'extracts' regions of concentrated activity in a fluctuating turbulence variable and labels each region individually for quantitative and graphical analysis, and applied the technique to the combined visual and quantitative analysis of vorticity, strain-rate, Reynolds stress and turbulent kinetic energy in the transition for isotropic to shear-dominated homogeneous turbulence. The focus of the second program is on interscale interactions in high Reynolds number turbulence, with a particular focus on the direct interaction between large and small scales in the dynamic evolution of equilibrium and nonequilibrium turbulent flows. Analytical analysis has demonstrated the persistence of these interactions in the high Reynolds number limit and basic analysis of the limiting triadic form of the Navier-Stokes equation has appeared in several publications. Based on predictions made from the asymptotic triadic equations, we have analysed the

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dynamics of direct large-small scale couplings through direct numerical simulations of initially isotropic turbulence forced anisotropically the large scales and found that large scale restructuring can dramatically alter small scale structure and dynamics. Turbulence, Shear flows, Scientific visualization.

DESCRIPTORS: (U) \*STRUCTURES, \*TURBULENCE, \*ENERGY TRANSFER, ALGORITHMS, COUPLINGS, DYNAMICS, INTERACTIONS, KINETIC ENERGY, LABELS, NAVIER STOKES EQUATIONS, NUMBERS, PREDICTIONS, QUANTITATIVE ANALYSIS, RATES, REYNOLDS NUMBER, SCALE, SIMULATION, STRAIN RATE, TRANSITIONS, TURBULENT FLOW, VARIABLES, MODIFICATION, VORTICES, STRESSES, ISOTROPISM, SHEAR PROPERTIES, FLOW, FLUID MECHANICS.

IDENTIFIERS: (U) PE81102F, WUAFOSR2307BS, \*Intercomponent, \*Interscale, \*Forcing.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HAMPTON VA  
LANGLEY RESEARCH CENTER

(U) Algorithms for Digital Micro-Wave Receivers and Optimal System Identification.

DESCRIPTIVE NOTE: Final technical rept. 1 Oct 92-30 Sep 93,

FEB 94 119P

PERSONAL AUTHORS: Shaw, Arnab K.

CONTRACT NO. F49620-93-1-0014

PROJECT NO. 2304

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0160, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The research in the Year-1 of this project has focused on two primary directions, as originally proposed, (i) Advanced signal processing algorithms for digital microwave receivers with Electronic Warfare applications: For estimating the Angles-Of-Arrival or Radio Frequencies, a significant contribution has been made with a computationally efficient Minimum-Norm Method that does not require any Eigenanalysis but produces equally good estimates. A Maximum-Likelihood Estimator (MLE) that ensures unit circle frequencies has been proposed for obtaining the most accurate estimates. Furthermore, two new algorithms for improved AR/ARMA spectrum estimator from noisy observations have been considered. Several time-domain and frequency-domain algorithms for detecting the presence of targets are also being studied. (ii) A general and unified theoretical framework for optimal identification of rational transfer function coefficients from: (1) Input-Output data, (2) Impulse Response data and (3) Frequency Response data. Unlike existing algorithms which either modify or linearize the error criterion to estimate the unknown parameters simultaneously, the true error criteria have been decoupled into (i) a purely linear problem for estimating the optimal numerator and (ii) a nonlinear

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problem with reduced dimensionality for the optimal denominator. The decoupled estimators possess global optimality properties but have reduced computational complexity than existing methods. Angles-of-Arrival estimation, Frequency estimation, Digital receiver design, Improved AR and ARMA modeling, Electronic Warfare (EW) signal detection, Optimal system identification from input/output and frequency domain data.

DESCRIPTORS: (U) \*ALGORITHMS, \*MICROWAVE RECEIVERS, \*DIGITAL SYSTEMS, ANGLES, ARRIVAL, CIRCLES, COEFFICIENTS, DETECTION, ELECTRONIC WARFARE, ELECTRONICS, ERRORS, ESTIMATES, FREQUENCY, FREQUENCY DOMAIN, FREQUENCY RESPONSE, GLOBAL, IDENTIFICATION, INPUT, MICROWAVES, OBSERVATION, OUTPUT, PARAMETERS, RADIO EQUIPMENT, RESPONSE, SIGNAL PROCESSING, SIGNALS, TARGETS, TIME, TIME DOMAIN, TRANSFER, TRANSFER FUNCTIONS, WARFARE, MAXIMUM LIKELIHOOD ESTIMATION.

IDENTIFIERS: (U) PEB1102F, WUAFOSR2304ES.

BELL COMMUNICATIONS RESEARCH INC LIVINGSTON NJ

(U) Research in VLSI System Implementation of Neuromorphic Learning Networks.

DESCRIPTIVE NOTE: Final rept. 1 Nov 92-31 Oct 94,

OCT 94 6P

PERSONAL AUTHORS: Alspector, Joshua

CONTRACT NO. F49620-92-C-0075

PROJECT NO. 7013

TASK NO. 00

MONITOR: AFOSR, XC  
TR-94-0217, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The methodology of the researchers was to build experimental prototype learning systems they wanted: to develop a prototype of an enhanced neuron/synapse chip using some ideas that they have gained from existing chips, develop a prototype VME based experimental platform for the above devices, write experimental prototype system software to run the above prototype boards and chips as co-processors for typical computer system such as a SUN4 and develop new algorithms to perform other types of learning suitable for prototype VLSI implementation. The following results were achieved: System Level Hardware-redesigned prototype learning chips were fabricated, System Level Software-software modules to interface with their prototype system has been written, Algorithms-theoretical and simulation experiments were carried out to gauge the efficiency of one-weight-at-a-time vs. parallel perturbations

DESCRIPTORS: (U) \*LEARNING MACHINES, \*CHIPS(ELECTRONICS), ALGORITHMS, EFFICIENCY, INTERFACES, NERVE CELLS, PERTURBATIONS, PROTOTYPES, SYNAPSE, VERY LARGE SCALE INTEGRATION, SOFTWARE ENGINEERING, COMPUTER NETWORKS, EXPERIMENTAL DESIGN.

IDENTIFIERS: (U) WUAFOSR701300, OWAT(One Weight At a Time), Neuromorphic learning networks.

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MOLECULAR TECHNOLOGIES INC LOWELL MA

(U) Organosilicon Polymeric Nonlinear Optical Materials  
for Optical Switching and Modulation.

DESCRIPTIVE NOTE: Final technical rept. 15 Jul 93-14 Jan  
94,

FEB 94 33P

PERSONAL AUTHORS: Sengupta, Sandip K.; Li, Lian; Chen,  
Jeng-I; Marturunkakul, Sutiyao; Cazeca, Mario

REPORT NO. MIT-0039-03F

CONTRACT NO. F49620-93-C-0039

MONITOR: AFOSR, XC  
TR-94-0243, AFOSR

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Availability: AFOSR/PKA, 110 Duncan  
Ave., Ste B115, Bolling AFB, Washington, DC 20332-0001.  
No copies furnished by DTIC/NTIS.

ABSTRACT: (U) The objective of the project was to  
develop new polymeric materials for second-order  
nonlinear optical (NLO) applications, specifically  
electro-optic applications. Alkoxysiloxane derivatives of  
organic azo dye chromophores were synthesized and used to  
prepare NLO siloxanes by the sol-gel reaction with a  
siloxane polymer. The dipole moments and polarizabilities  
and hyperpolarizabilities of the chromophores were  
calculated by semi-empirical quantum mechanical modeling.  
A novel approach using interpenetrating polymer networks  
(IPN) combining a sol-gel based NLO siloxane with a  
thermally crosslinkable NLO azo dye attached epoxy  
network, as stable second-order NLO materials was also  
introduced. In two of these systems, the addition of  
another crosslinkable azo dye component to boost the NLO  
density was investigated. The materials were processed  
into thin films on substrates and simultaneously oriented  
by corona poling and thermally cured at temperatures up  
to 220 deg C. The NLO siloxanes showed relatively weak  
optical nonlinearities while the electro-optic  
coefficients of the IPN systems were reasonable large and  
temporal stability was excellent-the materials showing

considerable promise for practical applications.

DESCRIPTORS: (U) \*OPTICAL MATERIALS, \*OPTICAL SWITCHING,  
\*MODULATION, \*ORGANIC MATERIALS, \*SILICON, NONLINEAR  
OPTICS, POLYMERS, ELECTROOPTICS, CHROMOPHORES, SYNTHESIS,  
DIPOLE MOMENTS, QUANTUM THEORY, CROSSLINKING(CHEMISTRY),  
EPOXY COMPOUNDS, THIN FILMS, SUBSTRATES, CORONAS, CURING,  
SILOXANES, THERMAL STABILITY, ALKOXY RADICALS.

IDENTIFIERS: (U) Polymeric materials, Second-order,  
Alkoxysiloxane, Azo dyes, Sol-gel process, Polarizability,  
Hyperpolarizability, IPN(Interpenetrating Polymer  
Networks), Interpenetrating polymer networks, Poling.

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AD-A278 243 5/8 6/4

OKLAHOMA UNIV NORMAN DEPT OF MATHEMATICS

YALE UNIV NEW HAVEN CT SCHOOL OF MEDICINE

(U) Estimation and Control of Parameters in Linear and Nonlinear Distributed Models of Flexible Structures.

(U) Cellular Analysis of the Startle Reflex.

DESCRIPTIVE NOTE: Final rept. 1 Nov 91-31 Oct 93,

DESCRIPTIVE NOTE: Annual rept. 1 Sep 92-31 Aug 93,

AUG 93

AUG 93 2P

FEB 94 22P

PERSONAL AUTHORS: White, Luther

PERSONAL AUTHORS: Davis, Michael

CONTRACT NO. AFOSR-91-0017

CONTRACT NO. F49620-92-J-0300

PROJECT NO. 2304

PROJECT NO. 3484

TASK NO. A1

TASK NO. S4

MONITOR: AFOSR, XC  
TR-94-0211, AFOSR

MONITOR: AFOSR, XC  
TR-94-0224, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

ABSTRACT: (U) This project seeks to study the estimation of elastic, damping, and material parameters inflexible structure. Of particular interest are problems in the design and estimation of parameters in structures made up of systems of coupled beams and plates, the estimation of parameters in models that may not have unique solutions, and the estimation and design of various plate and shell models incorporating, for example, large deformation, variable thickness, existing curvatures, contact and possible friction conditions

DESCRIPTORS: (U) \*FLEXIBLE STRUCTURES, \*ELASTIC PROPERTIES, \*DAMPING, DEFORMATION, FRICTION, PLATES, SHELLS(STRUCTURAL FORMS), CURVATURE, BEAMS(STRUCTURAL), MATHEMATICAL MODELS.

IDENTIFIERS: (U) WJAFOSR2304A1, PE61102F.

ABSTRACT: (U) In the ASSERT Award we are interested in how dopamine agonists affect baseline startle amplitude as well as the phenomenon of pre-pulse inhibition. To test this, we have been recording the compound action potential generated by an auditory stimulus at the level of the cochlear nucleus in freely moving rats using a bundle of four previously implanted 25 micrometers nichrome wires. Each of the dopamine agonists increased the amplitude of the auditory nerve response (NI component, latency = 0.75 msec - Meloni and Davis, 1993). This effect is larger following repeated administration of d-amphetamine on each of 7 days, indicating that it shows sensitization. This suggests that dopamine agonists ultimately can alter processes at the very beginning of the auditory system, which we believe may have considerable relevance for dopamine-induced disruption of auditory prepulse inhibition as well as auditory distractibility and even auditory hallucinations in people.

DESCRIPTORS: (U) \*DOPAMINE, \*COCHLEAR NERVE, \*REFLEXES, AMPHETAMINES, AMPLITUDE, AUDITORY NERVE, AWARDS, BUNDLES, INHIBITION, MANAGEMENT, MICROMETERS, NERVES, RATS, RESPONSE, TEST AND EVALUATION, WIRE, LEARNING, STIMULATION(GENERAL), MEMORY(PSYCHOLOGY).

IDENTIFIERS: (U) PE61103D, WJAFOSR3484S4, \*Startle

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reflex, Cochlear nucleus.

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GEORGE MASON UNIV FAIRFAX VA

(U) Solution Procedures for Large-Scale Combinatorial Optimization.

DESCRIPTIVE NOTE: Final rept. 1 Mar 90-31 Aug 93,

AUG 93 7P

PERSONAL AUTHORS: Hoffman, Karla L.

CONTRACT NO. F4620-90-C-0022

PROJECT NO. 2304

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0209, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Results of research performed under this grant have shown that problems having thousands, and sometimes millions, of variables can be solved using present-day technology based on mathematical results that utilize the structure underlying the problem and that incorporate related advances of the mathematical theory into a general approach called 'branch-and-cut'. The term 'branch-and-cut' and the ideas encompassing it, are the direct result of this research effort. Now the two leading commercial codes for solving integer programming problems, OSL and Cplex both incorporate cutting plane ideas and use the term 'branch-and-cut' in their marketing literature.

DESCRIPTORS: (U) \*LARGE SCALE INTEGRATION, \*INTEGER PROGRAMMING, COMBINATORIAL ANALYSIS, OPTIMIZATION, ALGORITHMS, HEURISTIC METHODS, PARALLEL PROCESSING, LINEAR PROGRAMMING.

IDENTIFIERS: (U) WUAFO5R2304CS, \*Branch and cut method

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AD-A277 937 20/3 9/1 20/13 AD-A277 937 CONTINUED  
CONDUCTUS INC SUNNYVALE CA IDENTIFIERS: (U) Tunable transmission

(U) High Temperature Superconducting Josephson Junction  
Array Systems. Phase 1.

DESCRIPTIVE NOTE: Final rept. 1 Jul-31 Dec 93.

JAN 94 29P

PERSONAL AUTHORS: Martens, J.; Pance, A.; Char, K.;  
Johansson, M.; Whiteley, S.

REPORT NO. REPT-94001-SBIR-1-F

CONTRACT NO. F49620-93-C-0041

MONITOR: AFOSR, XC  
TR-94-0132, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) High temperature superconducting Josephson arrays were investigated as possible millimeter wave sources. A junction technology was selected and improved to the point where radiation, near 1 microwatt off-chip, was measured from a variety of 2-dimensional arrays in the 70-160 GHz range. The arrays were tunable and were successfully coupled to a number of antennas for broadband, tunable transmission. Antennas for a variety of specific applications were selected on the basis of bandwidth requirements, impedance levels, polarization, and the possibility of sufficient monolithic integration. The final part of the program was a study of potential subsystems that would utilize these arrays. Interchip communications transceivers were studied and interchip coupling was demonstrated using two antenna-coupled arrays. The most promising application may be a monolithic clock source, near 100 GHz, for communications and signal processing systems. Josephson arrays, mm-wave sources.

DESCRIPTORS: (U) \*ARRAYS, \*HIGH TEMPERATURE, \*MILLIMETER WAVES, \*SIGNAL PROCESSING, \*SUPERCONDUCTIVITY, \*JOSEPHSON JUNCTIONS, ANTENNAS, BANDWIDTH, BROADBAND, CLOCKS, COUPLINGS, IMPEDANCE, INTEGRATION, POLARIZATION, PROCESSING, RADIATION, REQUIREMENTS, TEMPERATURE, SEMICONDUCTOR JUNCTIONS.

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AD-A277 900 9/1 7/4 20/10 20/8 AD-A277 900 CONTINUED  
 PD-LD INC PRINCETON NJ MULTIPLEXING, PLATINUM, CHEMICAL VAPOR DEPOSITION.

(U) Infrared Detectors Based on Si/SiGe Superlattices and  
 Silicide/SiGe Schottky Barriers Operating beyond 12um.

IDENTIFIERS: (U) WUAFOSR3005SS, RTCVD, CMOS,  
 Multiquantum, Wells, RTCVD(Rapid Thermal Chemical Vapor  
 Deposition), \*Rapid thermal chemical vapor deposition.

DESCRIPTIVE NOTE: Final rept. 1 Jul-31 Dec 93.

FEB 94 24P

PERSONAL AUTHORS: Ban, Vladimir S.

CONTRACT NO. F49620-93-C-0042

PROJECT NO. 3005

TASK NO. SS

MONITOR: AFOSR, XC  
 TR-94-0134, AFOSR

## UNCLASSIFIED REPORT

ABSTRACT: (U) Work performed in Phase I of this project clearly established the feasibility of using SiGe detectors in the LWIR region. The most important achievements are: Both, Schottky barrier and multiquantum well structures based on SiGe alloys and capable of detection in the LWIR region have been grown by the RTCVD epitaxial growth method; For the first time, the selective epitaxial growth of LWIR SiGe detectors on silicon substrates with CMOS circuitry has been demonstrated, thus showing that monolithically integrated detector-multiplexer structures are feasible; Schottky barrier detectors with cut-off wavelengths exceeding 10 micrometers have been demonstrated; Extensive spectral response, cut-off wavelength and dark current measurements for Schottky barrier detectors based on Pt silicide/SiGe alloys with Ge content ranging from 0 to 20% have been carried out and discussed. Infrared detectors, SiGe alloys, Schottky barrier detectors, Multiquantum wells.

DESCRIPTORS: (U) \*GERMANIUM, \*SUPERLATTICES, \*SCHOTTKY BARRIER DEVICES, ALLOYS, BARRIERS, DETECTION, DETECTORS, EPITAXIAL GROWTH, INFRARED DETECTORS, MEASUREMENT, PHASE, REGIONS, RESPONSE, SILICIDES, SILICON, STRUCTURES, SUBSTRATES, TIME, LONG WAVELENGTHS, QUANTUM WELLS, COMPLEMENTARY METAL OXIDE SEMICONDUCTORS, CIRCUITS,

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AD-A277 889 20/3 9/1 20/14

CALIFORNIA UNIV DAVIS

(U) Dielectric Loaded Broadband Gyro-TWT System.

DESCRIPTIVE NOTE: Final rept. 1 Jan 92-31 Dec 93,

DEC 93 12P

PERSONAL AUTHORS: Luhmann, N. C., Jr

CONTRACT NO. F49820-92-J-0175

PROJECT NO. 2301

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0136, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Basic research studies on the generation of high frequency waves at high power, while minimizing problematic technological requirements such as high voltage and intense magnetic fields.

DESCRIPTORS: (U) \*HIGH VOLTAGE, \*MAGNETIC FIELDS, \*DIELECTRICS, \*BROADBAND, HIGH FREQUENCY, HIGH POWER, POWER, REQUIREMENTS, MICROWAVE TUBES, TRAVELING WAVE TUBES, AMPLIFIERS, WAVEGUIDES.

IDENTIFIERS: (U) WUAFOSR2301ES, \*Gyro.

AD-A277 882 12/9 6/4

WRIGHT STATE UNIV DAYTON OH DEPT OF PSYCHOLOGY

(U) Pattern Analysis Based Models of Masking by Spatially Separated Sound Sources.

DESCRIPTIVE NOTE: Annual progress rept. 15 May 92-14 May 93,

JUN 93 14P

PERSONAL AUTHORS: Gilkey, Robert H.

CONTRACT NO. AFOSR-91-0289

PROJECT NO. 2313

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0137, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Research is described in three areas: masked detection, sound localization, and neural network models of sound localization. Work on masked detection indicates that substantial reductions in masking of 8 to 18 dB can be realized when the signal is spatially separated from the masker in the free-field. This reduction in masking appears to be mediated by high-frequency information. Headphone-based studies of reproducible noise masking question traditional models of binaural masking, by showing unexpected relations between responses under monaural and binaural conditions. A new response technique has been developed to support work on sound localization. Neural network models of sound localization based on binaural stimulus cues can produce responses comparable to those of human observers. Our efforts in laboratory development and in planning the Conference on Binaural and Spatial Hearing are also briefly described.

DESCRIPTORS: (U) \*HEARING, \*NEURAL NETS, \*AUDITORY PERCEPTION, \*EARPHONES, FREE FIELD, HIGH FREQUENCY, HUMANS, MASKING, MODELS, NOISE, RESPONSE, SIGNALS, SOUND, ACOUSTIC DETECTION, POSITION FINDING, NOISE(SOUND), CUES(STIMULI).

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A277 882 CONTINUED

IDENTIFIERS: (U) PE61102F, WUAFOSR2313CS

AD-A277 881 12/5 20/4

NEW YORK UNIV NY COURANT INST OF MATHEMATICAL SCIENCES  
(U) Adaptive Methods for Compressible Flow.

DESCRIPTIVE NOTE: Final technical rept. 1 Nov 90-30 Nov 93,

MAR 94 76P

PERSONAL AUTHORS: Berger, Marsha

CONTRACT NO. AFOSR-91-0063

PROJECT NO. 2304

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0131, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The goal of this research is the development of adaptive computational methods to numerically simulate fluid flows around complex configurations in an automatic fashion. Grid generation continues to be a huge impediment for computer simulations of realistic fluid flows. This is true for both body-fitted structured grid solvers and unstructured grid approaches. We are developing a Cartesian grid representation of the geometry, where the object is simply cut out of the Cartesian grid. We are also investigating the suitability of adaptive methods on parallel computers. Adaptive mesh refinement, Compressible fluid flows, Cartesian meshes.

DESCRIPTORS: (U) \*COMPUTERIZED SIMULATION, \*COMPRESSIBLE FLOW, \*COMPUTATIONAL FLUID DYNAMICS, \*MATHEMATICAL MODELS, APPROACH, AUTOMATIC, COMPUTERS, CONFIGURATIONS, FLUIDS, GEOMETRY, GRIDS, MESH.

IDENTIFIERS: (U) PE61102F, WUAFOSR2304CS, \*Adaptive computational methods, Cartesian grids

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BOSTON UNIV MA CENTER FOR ADAPTIVE SYSTEMS

ROBOTS, SEPARATION, SEQUENCES, SPEECH, STORAGE, STUDENTS,  
TECHNOLOGY TRANSFER, TIME, TRAINING, TRANSITIONS, VISION,  
VISUAL PERCEPTION.

(U) The Cognitive, Perceptual, and Neural Bases of Skilled  
Performance.

IDENTIFIERS: (U) PEB1103D, WUAFOSR3484HS.

DESCRIPTIVE NOTE; Final rept. 15 Mar 90-14 Mar 93,

FEB '94 88P

PERSONAL AUTHORS: Grossberg, Stephen

CONTRACT NO. AFOSR-90-0175

PROJECT NO. 3484

TASK NO. HS

MONITOR: AFOSR, XC  
TR-94-0067, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This three-year project partially supported three week-long international scientific meetings and courses on neural network research, 4 research books, more than 100 research articles, 68 Boston-area colloquia, 10 completed PhD theses, and the training of more than 20 graduate students. The research spanned a coordinated program of experimental and modeling studies of how the brain autonomously carries out intelligent behaviors in real-time in response to changing environmental contingencies. Neural models of 3-D vision and figure-around separation, motion perception, visual search, speech perception, working memories for storage of temporal sequences, supervised and unsupervised learning of recognition categories and predictions in response to nonstationary data, arm movement control, and quadruped gait transitions were developed. Technology transfers were made to processing of artificial sensor data, automatic target recognition, several industrial applications, and the control of mobile robots.

DESCRIPTORS: (U) \*NETWORKS, \*NEURAL NETS,  
\*PERCEPTION(PSYCHOLOGY), \*COGNITION, \*PERFORMANCE(HUMAN),  
\*SKILLS, AUTOMATIC, BOOKS, BRAIN, CONTROL, GRADUATES,  
INTERNATIONAL, LEARNING, MOBILE, MODELS, MOTION,  
PREDICTIONS, PROCESSING, REAL TIME, RECOGNITION, RESPONSE,

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ATLANTIC AEROSPACE ELECTRONICS CORP GREENBELT MD

(U) Application of Gabor Representation to Military Problems.

DESCRIPTIVE NOTE: Final rept. 5 Jan 90-4 Jul 93.

JUL 93 81P

PERSONAL AUTHORS: Orr, Richard S.

CONTRACT NO. F49620-90-C-0016

PROJECT NO. 7225

TASK NO. 00

MONITOR: AFOSR, XC  
TR-94-0086, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) In summary, the effort so far has proved in principle most of the supporting concepts, but has been insufficient to transition the work into the applications arena as yet. AAEC sees particular promise for this technology in certain applications areas, and is planning to propose effort in those areas. A key area is automatic target recognition (ATR). Machine-aided recognition problems have the feature that searching for objects can be enhanced in circumstances where shape characteristics of the objects are partially known in advance, either through a prior knowledge or data-aided algorithms. For example, in signal analysis, the Gabor transform is particularly adept at finding features having a common envelope. To maximally exploit such a circumstance, extraction of the analysis window from the data looms important. Given a large body of data such as that often encountered in an ATR problem, use of the data to drive the analysis functions seems wise as a measure to cut the amount of blind search, especially in view of findings that allegedly more 'robust' tools such as the Wigner distribution can create artifacts through nonlinear processing if not used carefully. The role for optimum Gabor windowing in this scheme is clear, and as a result it appears that the best way in which to continue the line of work discussed above is to do it within the context of an application area such as ATR. The research

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at the point where it could profit from the interaction with real data as an aid in algorithm development/refinement. AAEC anticipates proposing a body of work of his nature as a logical follow-on to the work performed in both this contract and the cited SBIR's.

DESCRIPTORS: (U) \*ALGORITHMS, \*SIGNAL PROCESSING, \*COMPUTER PROGRAMS, ARTIFACTS, AUTOMATIC, BODIES, CONTRACTS, DISTRIBUTION, DRIVES, EXTRACTION, FUNCTIONS, INTERACTIONS, MACHINES, PLANNING, PROCESSING, PROFITS, RECOGNITION, SEARCHING, SHAPE, TARGET RECOGNITION, TARGETS, TOOLS, TRANSITIONS, WINDOWS, WORK.

IDENTIFIERS: (U) WUAFOSR722500.

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DTIC REPORT BIBLIOGRAPHY

AD-A277 608 6/5 5/9

STUTTGART UNIV (GERMANY F R) INST FUER MIKROBIOLOGIE  
(U) Biodegradation of 2,4,6-trinitrotoluene: Strategies  
for the Selection of Novel Catabolic Potential.

DESCRIPTIVE NOTE: Final rept. 15 Apr 92-15 Aug 93,

SEP 93 21P

PERSONAL AUTHORS: Knackmuss, Hans-Joachim

CONTRACT NO. AFOSR-91-0237

PROJECT NO. 4982

TASK NO. 07

MONITOR: AFOSR, XC  
TR-94-0128, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The meeting brought together an enormous assortment of interests including academic analysts and biomedical researchers, program managers project directors, writers, and activities Drug and pharmaceutical representatives, interest group managers, book exhibitors, and professional protestors combined to create the atmosphere of a gigantic bazaar. Berlin gave us proof, if we needed it, that AIDS has become a very big business. Unquestionably, the IX International conference in Berlin June 7-11 was the largest of its kind. Some 15,000 participants, including 1500 members of the press corp, came together to review the struggle against HIV and AIDS. No break-throughs were announced and no startling discoveries seized the headlines. There was some sense of scientific advance in fighting opportunistic diseases and in understanding the life cycle and biology of HIV, but overall Berlin was a 'business as usual' enterprise. Conference, AIDS

DESCRIPTORS: (U) \*HUMAN IMMUNODEFICIENCY VIRUSES.  
\*ACQUIRED IMMUNE DEFICIENCY SYNDROME, \*ARMY PERSONNEL,  
\*SYMPTOMIA, ANALYSTS, ATMOSPHERES, BERLIN, BIOLOGY, BOOKS,  
COMMERCE, CYCLES, DISEASES, DRUGS, INTERNATIONAL, LIFE  
CYCLES, WORKSHOPS.

IDENTIFIERS: (U) PE61102F, WUAFOSR498207.

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SEARCH CONTROL NO. T4P42J

AD-A277 605 5/8 6/4

STATE UNIV OF NEW YORK AT BINGHAMTON PSYCHOACOUSTICS AND  
AUDITORY COGNITION LA B

(U) Psychophysics of Complex Auditory and Speech Stimuli.

DESCRIPTIVE NOTE: Annual rept. 1 Nov 92-31 Oct 93,

OCT 93 184P

PERSONAL AUTHORS: Pastore, Richard E.

CONTRACT NO. F49620-93-1-0033

PROJECT NO. 2313

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0108, AFOSR

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Original contains color plates: All  
DTIC and NTIS reproductions will be in black and white.

ABSTRACT: (U) A major focus on the primary project is to use of different procedures to provide converging evidence on the nature of perceptual spaces for speech categories. Completed research examined initial voiced consonants, with results providing strong evidence that different stimulus properties may cue a phoneme category in different vowel contexts. Thus, /b/ is cued by a rising second format (F2) with the vowel /a/, requires both F2 and F3 to be rising with /i/, and is independent of the release burst for these vowels. Furthermore, cues for phonetic contrasts are not necessarily symmetric, and the strong dependence of prior speech research on classification procedures may have led to errors. Thus, the opposite (falling F2 and F3) transitions lead somewhat ambiguous percepts (i.e., not/b/) which may be labeled consistently (as /d/ or /g/), but requires a release burst to achieve high category quality and similarity to category exemplars). Ongoing research is examining cues in other vowel contexts, and issuing procedures to evaluate the nature of interaction between cues for categories of both speech and music

DESCRIPTORS: (U) \*CUES(STIMULI), \*SPEECH, PSYCHOPHYSICS,

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DTIC REPORT BIBLIOGRAPHY

SEARCH CONTROL NO. T4P42J

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AUDITORY ACUITY, COGNITION, RESPONSE, HUMANS, SOUND, FREQUENCY.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2313AS.

AD-A277 604 20/6 17/9 9/3

MASSACHUSETTS UNIV LOWELL DEPT OF PHYSICS

(U) Bistatic Clutter RCS Simulation Using Scale Model Surfaces with Two Scale Roughness.

DESCRIPTIVE NOTE: Final rept. 1 Jun 92-31 Aug 93,

OCT 93 44P

PERSONAL AUTHORS: Fried, Zoltan

CONTRACT NO. F49620-92-J-0212

PROJECT NO. 2304

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0091, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Bistatic scattering cross section measurements of CO2 laser radiation from slightly roughened metallic surfaces were made and compared to the predictions of the Rice theory. Co-pol and cross pol measurements were performed both in and out of the plane of incidence. The incident radiation was linearly polarized in either the H or V configuration, perpendicular and parallel to the plane of incidence, respectively. For each state of incident polarization the scattered polarization was analyzed along two directions, perpendicular, (HH) and (HV), and parallel, (VH) and (VV), to the scattering plane. The Rice theory predicts the polarization dependent scattering cross section from a roughened surface with small scale roughness. Small scale roughness is defined in terms of  $h/\lambda$ , where  $h$  is the rms value of the randomly distributed surface depths and  $\lambda$  the wavelength of the incident radiation. A roughened surface with  $h/\lambda < 1/2\pi$  is considered to be small scale. The aluminum surfaces that were prepared for targets all satisfied the criteria for small scale roughness. The rms depth was obtained from specular reflection data which was fitted to the Davies formula, and the average slopes were obtained from profilometric traces.

DESCRIPTORS: (U) \*RADAR CROSS SECTIONS, \*ELECTROMAGNETIC

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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SCATTERING, \*BISTATIC RADAR, \*CARBON DIOXIDE LASERS,  
LASER BEAMS, SURFACE ROUGHNESS, METALS, ELECTROMAGNETIC  
WAVE PROPAGATION, SCALE MODELS, ELECTROMAGNETIC WAVE  
REFLECTIONS, ANGLE OF INCIDENCE, ALUMINUM, RADAR CLUTTER.

STUTTGART UNIV (GERMANY F R) INST FUER MIKROBIOLOGIE  
(U) Biodegradation of 2,4,6-trinitrotoluene: Strategies  
for the Selection of Novel Catabolic Potential.

IDENTIFIERS: (U) PE81102F, WUAFOSR23048S, Rice theory

DESCRIPTIVE NOTE: Final rept. 15 Apr 92-15 Aug 93,

SEP 93 21P

PERSONAL AUTHORS: Knackmuss, Hans-Joachim

CONTRACT NO. AFOSR-91-0237

PROJECT NO. 4982

TASK NO. 07

MONITOR: AFOSR, XC  
TR-94-0128, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Polynitrophenols were used as model compounds for the metabolism of 2,4,6-trinitrotoluene. Oxidative as well as reductive initial reactions were observed during catabolism of polynitrophenols. The elimination of nitrite by an oxygenolytic mechanism was demonstrated with 2,6-dinitrophenol whereas 2,4-dinitrophenol or picric acid were subject to a nucleophilic reductive attack. The formation of a hydride-Meisenheimer complex followed by an elimination of nitrite leading to 2,4-dinitrophenol was also observed in cell-free systems. 2,4,6-trinitrotoluene was subject to a nucleophilic attack by a hydride ion leading to a Meisenheimer complex as the initial metabolite. The hydride-Meisenheimer complex of 2,4,6-trinitrotoluene was synthesized chemically as a reference and identified by spectroscopic methods. In an anaerobic sludge supplemented with glucose and ammonia all nitro groups of 2,4,6-trinitrotoluene were reduced completely leading to 2,4,6-triaminotoluene which seemed to be further transformed under anaerobic conditions.

DESCRIPTORS: (U) \*CATABOLISM, \*NITRITES, \*TNT,  
\*DEGRADATION, ACIDS, AMMONIA, CELLS, ELIMINATION, GLUCOSE,  
HYDRIDES, IONS, METABOLISM, METABOLITES, MODELS, PICRIC  
ACID, SLUDGE, GERMANY, NITROPHENOLS, NITROTOLUENES,  
POLYMERS, NUCLEOPHILIC REACTIONS, ANAEROBIC PROCESSES,

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SEARCH CONTROL NO. T4P42J

AD-A277 603 CONTINUED

OXIDATION, EXPLOSIVES, CONTAMINATION, SOILS, GROUND WATER, REDUCTION(CHEMISTRY), MICROBIOLOGY.

IDENTIFIERS: (U) PE61102F, WUAFOSR498207, Foreign reports, \*Biodegradation, Oxygenolytic, Meisenheimer, Triaminotolene

AD-A277 601 7/4 7/3 20/5

COLUMBIA UNIV NEW YORK DEPT OF CHEMISTRY

(U) UV-vis Absorption Studies of Singlet to Triplet Intersystem Crossing Rates of Aromatic Ketones: Effects of Molecular Geometry,

94 10P

PERSONAL AUTHORS: McGarry, Peter F.; Doubleday, Charles E. Jr; Wu, Chung-Hsi; Staab, Heinz A.; Turro, Nicholas J.

CONTRACT NO. AFOSR-91-0340

PROJECT NO. 2303

TASK NO. B2

MONITOR: AFOSR, XC  
TR-94-O124, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Photochemistry and Photobiology A: Chemistry, v77 p109-117, 1994. Available to DTIC users only. No copies furnished by NTIS.

ABSTRACT: (U) The effect of the molecular geometry of diaryl and arylalkyl ketones on the rate of intersystem crossing (ISC) was investigated by employing picosecond pump-probe studies of the growth of triplet-triplet absorptions at 532 and 355 nm. Vibrational relaxation within the triplet manifold was found to interfere with measurement of the ISC rates for certain benzophenone derivatives. The observed rapid decay of absorption at 355 nm is attributed to relaxation of vibrationally excited triplets. The trends observed are consistent with direct singlet-to-triplet ISC from S(sub 1) to T(sub 1). (Author)

DESCRIPTORS: (U) \*ABSORPTION, \*KETONES, \*AROMATIC COMPOUNDS, MOLECULAR PROPERTIES, REPRINTS, GEOMETRY, ULTRAVIOLET SPECTRA, VISIBLE SPECTRA, ALKYL RADICALS, ARYL RADICALS, PUMPING(ELECTRONICS), PROBES, VIBRATION, RELAXATION, DECAY, EXCITATION, LASERS, FLASHES, PHOTOLYSIS, BENZOPHENONES.

IDENTIFIERS: (U) PE61102F, WUAFOSR230382, \*Singlet state, \*Triplet state, \*Intersystem crossing, Picosecond,

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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Cyclophanes

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CORNELL UNIV ITHACA NY LAB OF ATOMIC AND SOLID STATE  
PHYSICS

(U) Dynamics of Resonant Charge Transfer in Low-Energy  
Alkali-Metal-Ion Scattering,

OCT 93 16P

PERSONAL AUTHORS: Kimmel, G. A.; Cooper, B. H.

CONTRACT NO. AFOSR-88-0069, \$AFOSR-91-0137

PROJECT NO. 2303

TASK NO. A2

MONITOR: AFOSR, XC  
TR-94-0119, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Physical Review B, v48 n16 p12164-12177, 15 Oct 93. Available to DTIC users only. No copies furnished by NTIS.

ABSTRACT: (U) We show in this paper that measurements of charge-state distributions for 5-16000 eV Li, Na, and K scattered from a clean Cu(001) surface provide an excellent probe of the dynamics of atom-surface charge transfer. The neutralization probabilities, measured as a function of the perpendicular velocities of the scattered atoms, are qualitatively different for the three species. These differences reflect the high sensitivity of the charge transfer in this energy range to the energies and lifetimes of the atomic resonances near the surface. The measured neutralization probabilities are found to depend on the parallel velocity component of the scattered atom, even though the velocities at which these experiments are conducted are relatively low. The data are compared to several models of the charge-transfer process. Agreement with the data is achieved using a model based on the one-electron Newns-Anderson Hamiltonian and using calculated values for the alkali-metal resonance parameters

DESCRIPTORS: (U) \*RESONANCE, \*CHARGE TRANSFER, \*LOW ENERGY, \*ALKALI METALS, \*IONS, \*SCATTERING, DYNAMICS, REPRINTS, MEASUREMENT, ELECTRONIC STATES, LITHIUM, SODIUM,

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POTASSIUM, SURFACES, ATOMS, NEUTRALIZATION, VELOCITY,  
COPPER, MOLECULES.IDENTIFIERS: (U) PE81102F, WUAFOSR2303A2, Lifetimes,  
perpendicular velocity, Parallel velocity, \*Resonant  
charge exchange process

AD-A277 599 7/4 20/5 20/3

JOINT INST FOR LAB ASTROPHYSICS BOULDER CO

(U) Collision-Induced Neutral Loss Reactions of Molecular  
Dications,

NOV 93 10P

PERSONAL AUTHORS: Price, Stephen D.; Manning, Michelle;  
Leone, Stephen R.

CONTRACT NO. F49620-91-J-0071

PROJECT NO. 2303

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0125, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Chemical Physics Letters, v214 n6  
p553-558, 19 Nov 93. Available to DTIC users only. No  
copies furnished by NTIS.

ABSTRACT: (U) Collision-induced neutral loss reactions  
are observed to be a major product channel for reactions  
of CF<sub>3</sub>(2+), SF<sub>4</sub>(2+), SF<sub>3</sub>(2+), and SF<sub>2</sub>(2+) with the rare  
gases at 49 eV laboratory collision energy. This  
reactivity, which involves the formation of doubly  
charged molecular daughter ions, differs markedly from  
that observed for other molecular dications. The double  
charged product ion yield is largest for systems in which  
charge transfer does not compete effectively with the  
collision-induced process. (Author)

DESCRIPTORS: (U) \*CATIONS, \*MOLECULAR STRUCTURE,  
\*COLLISIONS, \*SULFUR, \*FLUORIDES, \*CARBON, \*RARE GASES,  
\*REPRINTS, CHEMICAL REACTIONS, ENERGY, CHARGED PARTICLES,  
CHARGE TRANSFER, KINETIC ENERGY, MASS SPECTROMETERS, ION  
BEAMS, XENON, NEON.

IDENTIFIERS: (U) PE81102F, WUAFOSR2303ES, \*Dications,  
\*Neutral Loss, Induced, Double Charges, Quadrupole,  
Chemical Physics

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PITTSBURGH UNIV PA DEPT OF CHEMISTRY

PITTSBURGH UNIV PA DEPT OF CHEMISTRY

(U) Temperature Control and Measurement for Diamond Single Crystals in Ultrahigh Vacuum,

(U) Characterization of Heated Platinum Filaments as a Source of Atomic Oxygen,

DEC 93 6P

FEB 94 5P

PERSONAL AUTHORS: Smentkowski, V. S.; Yates, J. T., Jr

PERSONAL AUTHORS: Smentkowski, V. S.; Yates, J. T., Jr

CONTRACT NO. F49620-92-J-0192

CONTRACT NO. F49620-92-C-0192

PROJECT NO. 2303

PROJECT NO. 2302

TASK NO. BS

TASK NO. BS

MONITOR: AFOSR, XC  
TR-92-0123, AFOSRMONITOR: AFOSR, XC  
TR-94-0118, AFOSR

UNCLASSIFIED REPORT

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. Vac. Sci. Technol. A., v11 n8. p3002-3006, Nov/Dec 93. Available to DTIC users only. No copies furnished by NTIS.

Availability: Pub. in Jnl. Vac. Sci. Technol. A., v12 n1 p224-227, Jan/Feb 94. Available to DTIC users only. No copies furnished by NTIS.

ABSTRACT: (U) A method for reproducibly heating diamond single crystals is described. Measurements of the actual diamond temperature are made using a pair of embedded thermocouples. Both, steady state and temperature programmed heating methods have been characterized. It is demonstrated that diamond temperatures, when estimated by measuring the temperature of the heating support, may be in error by hundreds of degrees K. Diamond, Ultrahigh vacuum, Temperature measurement, Temperature programming

ABSTRACT: (U) Hot platinum filaments, for the production of atomic oxygen, have been characterized by two complementary techniques: line-of-sight gas phase analysis and surface trapping experiments using a gold substrate. It is demonstrated by both techniques that platinum is detected prior to detectable atomic oxygen production. This calls into question previous studies which have employed Pt as a thermal source of atomic oxygen for research purposes. Atomic oxygen, Active oxygen, Platinum, Chemisorption, Platinum oxides, Diamond

DESCRIPTORS: (U) \*DIAMONDS, \*MEASUREMENT, \*SINGLE CRYSTALS, \*TEMPERATURE, \*ULTRAHIGH VACUUM, COMPUTER PROGRAMMING, ERRORS, HEATING, STEADY STATE, THERMOCOUPLES, REPRINTS, THERMAL CONDUCTIVITY.

DESCRIPTORS: (U) \*FILAMENTS, \*OXYGEN, \*PLATINUM, \*SURFACES, \*ATOMIC PROPERTIES, \*HEAT, CHEMISORPTION, DIAMONDS, GOLD, LINE OF SIGHT, OXIDES, PHASE, PRODUCTION, SUBSTRATES, VISION, REPRINTS, GASES, TRAPPING(CHARGED PARTICLES), MASS SPECTROMETRY, DEPOSITION.

IDENTIFIERS: (U) PE61102F, WUAFOSR2303B5, Radiative heating, Electron bombardment

IDENTIFIERS: (U) PE61102F, WUAFOSR2303B5, \*Atomic oxygen

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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AD-A277 546 20/5 7/4

NORTHWESTERN UNIV EVANSTON IL

JOHNS HOPKINS UNIV BALTIMORE MD DEPT OF CHEMISTRY

(U) Reading: Interaction With Memory.

(U) On the Intersection of Two Potential Energy Surfaces of the Same Symmetry. Systematic Characterization Using a Lagrange Multiplier Constrained Procedure,

DESCRIPTIVE NOTE: Final rept. 1 Mar 90-31 Aug 93,

DEC 93 170P

OCT 93 7P

PERSONAL AUTHORS: McKoon, Gail

PERSONAL AUTHORS: Manaa, M. R.; Yarkony, David R.

CONTRACT NO. AFOSR-90-0246

CONTRACT NO. F49620-93-1-0067

PROJECT NO. 2313, 6912

MONITOR: AFOSR, XC  
TR-94-0121, AFOSR

TASK NO. BS, OR

UNCLASSIFIED REPORT

MONITOR: AFOSR, XC  
TR-94-0097, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) The topic of the supported research was reading, and the ways information in memory can contribute to the inference processes that occur during reading. One source of information for inference processes is short-term memory for parts of a text that have already been read. Experiments investigated how this information is made available to allow, for example, inferences that decide the correct referent of a pronoun, or inferences that relate via causality two events described by the text. Experiments also examined the local representation constructed for a text, testing our proposal that locally available information is structured by the linguistic, semantic, and pragmatic means by which the information is expressed. A second line of research examined interactions between inference processes and well-known information from long-term memory, examining knowledge of the semantic structures of verbs, knowledge of what concepts are frequently associated with each other, and knowledge about how lexical items are used in various contexts. Reading, Memory, Language, Comprehension

**DESCRIPTORS:** (U) \*READING, \*MEMORY (PSYCHOLOGY), COMPREHENSION, INTERACTIONS, LANGUAGE, LINGUISTICS, SEMANTICS, STRUCTURES.

**IDENTIFIERS:** (U) WUAFOSR2313BS, WUAFOSR69120R, PE81102F.

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**Availability:** Pub. in Jnl. of Chemical Physics, v99 n7 p5251-5256, 1 Oct 93. Available only to DTIC users. No copies furnished by NTIS.

**ABSTRACT:** (U) Two nonrelativistic Born-Oppenheimer potential energy surfaces of the same space-spin symmetry may intersect on a surface of dimension N-2, where N is the number of internal nuclear degrees of freedom. Characterization of this entire surface can be quite costly. An algorithm, employing multiconfiguration self-consistent-field (MCSCF)/configuration interaction (CI) wave functions and analytic gradient techniques, is presented that avoids the determination of the full N-2 dimensional surface, while directly locating portions of the crossing surface that are energetically important.

**DESCRIPTORS:** (U) \*POTENTIAL ENERGY, \*MOLECULAR STATES, ALGORITHMS, CROSSINGS, DEGREES OF FREEDOM, SURFACES, SYMMETRY, WAVE FUNCTIONS, ADIABATIC CONDITIONS, MOLECULE MOLECULE INTERACTIONS, MOLECULAR STRUCTURE, MOLECULAR STRUCTURE, MOLECULAR ENERGY LEVELS, REPRINTS.

**IDENTIFIERS:** (U) Nonadiabatic processes, Langrangian multipliers, Born oppenheimer potential energy surfaces, MCSCF(Multiconfiguration Self Consistent Field), Langrangian functions

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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EEG SYSTEMS LAB SAN FRANCISCO CA

(U) Neuro-Triggered Training.

IDENTIFIERS: (U) WUAFOSR2313BS, PEB1102F.

DESCRIPTIVE NOTE: Annual rept. 1 Apr 90-31 Mar 93.

MAR 93 6P

PERSONAL AUTHORS: Gevins, Alan S.; Leong, Harrison

CONTRACT NO. F49620-90-C-0028

PROJECT NO. 2313

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0104, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) We made progress in several areas during the past year: (1) tested the Neurotrigger hardware/software system and moved it onto a new platform for increased number of channels and a needed increase in computational headroom; (2) performed pilot recordings seeking simpler EEG measures of focused attention associated with heightened ability to receive and retain information; (3) implemented filters to remove signal contaminants typically generated by stationary subjects doing laboratory tasks, specifically eye blinks, eye movements, and muscle tension on the head; (4) designed, implemented, and piloted a new task for training the production of a preparatory attentive state associated with heightened ability to receive and retain information. We also revised a manuscript on a prior AFOSR-sponsored study of working memory; the manuscript has been accepted for publication. We also completed statistical analyses and figures and nearly completed a manuscript on a prior AFOSR-sponsored experiment on the neurophysiology of language. Brain activity, Cognition, Learning

DESCRIPTORS: (U) \*BRAIN, \*COGNITION, \*LANGUAGE, \*LINGUISTICS, ATTENTION, CHANNELS, CONTAMINANTS, DOCUMENTS, EYE, EYE MOVEMENTS, FILTERS, HEAD(ANATOMY), LABORATORIES, LEARNING, MUSCLES, NEUROPHYSIOLOGY, NUMBERS, PILOTS, PLATFORMS, PRODUCTION, SIGNALS, STATIONARY, TENSION, TRAINING, METHODOLOGY, PAPER.

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SEARCH CONTROL NO. T4P42J

AD-A277 532 17/9

TEXAS TECH UNIV LUBBOCK DEPT OF ELECTRICAL ENGINEERING

(U) Adaptive Estimation and Approximation of Continuously Varying Spectral Density Functions to Airborne Radar.

DESCRIPTIVE NOTE: Final rept. 15 Nov 91-14 Nov 93,

NOV 93 26P

PERSONAL AUTHORS: Emre, Ero1

CONTRACT NO. F49620-92-J-0044

PROJECT NO. 2304

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0090, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The Target Reflectivity Frequency Response is estimated through an extension of the MUSIC-PISARENKO technique. Density function estimation will enable passive sensors to sort incoming angles and frequency. Time variation tracking is provided as an alternative to adaptive beam-forming. Noise is taken fully into consideration. Wavelet and Gabor filters applied to range doppler density evaluation.

DESCRIPTORS: (U) \*RADAR TRACKING, \*DOPPLER SYSTEMS, ANGLES, BEAM FORMING, DENSITY, FILTERS, FREQUENCY RESPONSE, FUNCTIONS, MUSIC, NOISE, REFLECTIVITY, RESPONSE, TARGETS, TIME, TRACKING, VARIATIONS.

IDENTIFIERS: (U) WUAFOSR2304ES.

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WASHINGTON UNIV SEATTLE

(U) A Numerical Study of Thunderstorm Electrification.

DESCRIPTIVE NOTE: Final rept. 11 Nov 90-30 Nov 93,

JAN 94 3P

PERSONAL AUTHORS: Baker, Marcia B.

CONTRACT NO. AFOSR-91-0012

PROJECT NO. 2310

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0066, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The purpose of this research was to pursue further understanding of cloud electrification through three separate projects. First, radar observational data of New Mexico thunderstorm activity combined with a numerical thunderstorm model suggests that the degree of thunderstorm electrification depends on the time during which strong updrafts remain within the charging zone. Second, a simple numerical lightning model representing streamer propagation on a 2-D grid was developed. Realistic streamer paths evolve in the model and the conditions for IC and CG strokes are directly related to updraft velocity. Third, a simple cloud model was utilized to investigate factors influencing lightning frequency and its relationship to precipitation. Lightning and lightning frequency are shown to heavily depend on the depth of the charging region which is sensitive to vertical velocity.

DESCRIPTORS: (U) \*CLOUD PHYSICS, \*THUNDERSTORMS, \*ATMOSPHERIC ELECTRICITY, LIGHTNING, CHARGE DENSITY, \*ATMOSPHERIC DISTURBANCES, NEW MEXICO, PRECIPITATION, ZONE CHARGES, ELECTRIC FIELDS, ELECTROMAGNETIC WAVE PROPAGATION, ATMOSPHERE MODELS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2310CS, Thunderstorm electrification, Streamer propagation.

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

AD-A277 530 7/8 7/4 11/4 7/3 AD-A277 530 CONTINUED

MINNESOTA UNIV MINNEAPOLIS DEPT OF CHEMICAL ENGINEERING  
AND MATERIALS SCIENCE

(U) Phase Behavior, Structure, and Properties of Model  
Block Polymers.

encountered near the order-disorder transition.  
Conformational asymmetry, which is controlled by the  
block volume and radius of gyration, leads to different  
phases on either side of the phase diagram. These effects  
have not been accounted for theoretically.

DESCRIPTIVE NOTE: Final rept. 15 Apr 90-14 Oct 93,

OCT 93 15P

PERSONAL AUTHORS: Bates, Frank S.

CONTRACT NO. AFOSR-90-0207

PROJECT NO. 3484

TASK NO. RS

MONITOR: AFOSR, XC  
TR-94-0094, AFOSR

DESCRIPTORS: (U) \*BLOCK COPOLYMERS, \*MODELS, \*PHASE  
DIAGRAMS, \*PHYSICAL PROPERTIES, \*STRUCTURES, \*ORDER  
DISORDER, TRANSFORMATIONS, AMPLITUDE, ASYMMETRY, BEHAVIOR,  
COPOLYMERS, DYNAMICS, HYDROCARBONS, HYDROGENATION,  
MATERIALS, MELTS, MICROSTRUCTURE, NEUTRON SCATTERING,  
PARAMETERS, PHASE, POLYMERIZATION, POLYMORPHISM, PROBES,  
RHEOLOGY, SPECTROSCOPY, VARIATIONS, ANIONS, CATALYSIS,  
SATURATION, MECHANICS, DIENES, COMPOSITE MATERIALS,  
POLYETHYLENE.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484RS, \*Polydiene,  
\*Shearing, SANS(Small Angle Neutron Scattering), Gyration,  
Poly(ethylene propylene), Poly(ethylene).

UNCLASSIFIED REPORT

ABSTRACT: (U) This project brought together three  
distinct experimental methods in an integrated  
investigation of the phase behavior, structure and  
properties of block copolymers in the vicinity of the  
order-disorder transition. Anionic polymerization of  
polydiene diblock copolymers followed by catalytic  
hydrogenation was used to produce three classes of model  
saturated hydrocarbon materials. Dynamic mechanical  
spectroscopy and large amplitude dynamic shearing were  
employed to probe and manipulate, respectively, the melt  
state microstructure. Small angle neutron scattering  
(SANS) experiments provided detailed information  
regarding the structure of the materials. A significant  
achievement during this work was the development of a  
dynamic shearing device that could be operated in situ  
with a SANS instrument. Together with the spectrum of  
materials produced, this combined scattering-rheology  
technique has led to a qualitative improvement in our  
understanding of block copolymer phase behavior, and  
uncovered a rich polymorphism that is accompanied by  
dramatic variations in physical properties. Two new  
parameters have been shown to play a crucial role in  
determining block copolymer phase behavior. The degree of  
polymerization, controls the extent of composition  
fluctuations which strongly affects the types of phases

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42U

AD-A277 529 12/3

STATE UNIV OF NEW YORK AT STONY BROOK DEPT OF APPLIED  
MATHEMATICS AND STATISTI CS

(U) Stochastic Models in Reliability Theory.

DESCRIPTIVE NOTE: Final rept. 1 Dec 91-30 Nov 93,

DEC 93 5P

PERSONAL AUTHORS: Baxter, Laurence

CONTRACT NO. F49620-92-J-0101

PROJECT NO. 2304

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0087, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During the two years of research supported  
by this grant, the PI worked on several different  
problems in reliability, theory, both statistical  
estimation and stochastic modeling as well as topics in  
manufacturing.

DESCRIPTORS: (U) \*MARKOV PROCESSES, \*STOCHASTIC CONTROL,  
\*NONPARAMETRIC STATISTICS, MANUFACTURING, RELIABILITY,  
THEORY, TIME SERIES ANALYSIS, FACTOR ANALYSIS, LIFE  
EXPECTANCY(SERVICE LIFE), PARALLEL PROCESSING.

IDENTIFIERS: (U) WUAFOSR2304ES.

AD-A277 528 20/5

FLORIDA AGRICULTURAL AND MECHANICAL UNIV TALLAHASSEE

(U) Accurate LCAO Ground State Calculations of HeH(2+)  
Using Slater-Type Orbitals,

93 5P

PERSONAL AUTHORS: Etemadi, Babak; Jones, Herbert W.

CONTRACT NO. F49620-92-J-0063

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0120, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in International Jnl. of Quantum  
Chemistry: Quantum Chemistry Symposium 27, p755-758 1993.  
Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) A linear combination of atomic orbitals  
(LCAO) of the Slater type is used in a variational  
treatment of the HeH(2+) ion to achieve excellent results  
for the ground state energy of this heteronuclear  
diatomic system. As in our recent treatment of H(+) sub 2,  
we use orbitals with identical screening constants but  
with increasing principal quantum numbers and angular  
momentum. This strategy was feasible because of our  
ability to accurately evaluate all overlap integrals.  
Unlike even tempered Gaussian-type LCAO, our results  
become more accurate at large interatomic separations.  
Using two different screening constants (one type  
associated with each atom) proved to be unnecessary.  
Slater-type orbitals, LCAO, Overlap integrals, HeH(2+)

DESCRIPTORS: (U) \*ATOMIC ORBITALS, \*DIATOMIC MOLECULES,  
\*IONS, ANGULAR MOMENTUM, COMPUTATIONS, GROUND STATE,  
ELECTRON ENERGY, REPRINTS.

IDENTIFIERS: (U) PES1102F, WUAFOSR2303FS, Slater type  
orbitals, LCAO(Linear Combination of Atomic Orbitals),  
Gaussian type orbitals, Nuclear separations.

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## DTIC REPORT BIBLIOGRAPHY

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AD-A277 528 12/9 20/1

JOHNS HOPKINS UNIV BALTIMORE MD DEPT OF CHEMISTRY

BOSTON UNIV MA

(U) Systematic Determination of Intersections of Potential Energy Surfaces Using a Lagrange Multiplier Constrained Procedure.

93 9P

PERSONAL AUTHORS: Yarkony, David R.

CONTRACT NO. F49620-93-1-0067

PROJECT NO. 2303

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0122, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. of Physical Chemistry, v97 p4407-4412 1993. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) Two nonrelativistic Born-Oppenheimer potential energy surfaces of distinct space-spin symmetry intersect on surface of dimension N-1 where N is the number of internal nuclear degrees of freedom. Characterization of this entire surface can be quite costly. An algorithm, employing multiconfiguration self-consistent-field (MCSCF)/configuration interaction (CI) wavefunctions and analytic gradient techniques, is presented which avoids the determination of the full N-1 dimensional surface, while directly locating portions of the crossing surface that are energetically important.

DESCRIPTORS: (U) \*MOLECULAR STATES, \*POTENTIAL ENERGY, ALGORITHMS, CROSSINGS, DEGREES OF FREEDOM, MOLECULAR STRUCTURE, WAVE FUNCTIONS, MOLECULE MOLECULE INTERACTIONS, ELECTRON SPIN RESONANCE, SURFACES, SYMMETRY, MOLECULAR ENERGY LEVELS, REPRINTS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2303FS, MCSCF(Multiconfiguration Self Consistent Field), Crossing surfaces, Born Oppenheimer potential energy surfaces, Lagrange multipliers.

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DESCRIPTIVE NOTE: Annual rept. 1 May 92-30 Apr 93,

JAN 94 13P

PERSONAL AUTHORS: Grossberg, Stephen; Cohen, Michael

CONTRACT NO. F49620-92-J-0225

PROJECT NO. 2313

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0107, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This project is developing autonomous neural network models for the real-time perception and production of acoustic and speech signals. A new acoustic filter was developed to show how coarticulated and sensitive auditory signals can be separated and represented in a more context-independent fashion, thereby easing the recognition problem. Parallel processing streams sensitive to sustained and transient signals are used, as in vision. A model of working memory was developed that automatically compensates for variable acoustic or speech rates. The model shows how invariance of the short term storage of variable-rate acoustic streams can explain data about categorical boundary shifts when the distributions of silent intervals or of vowel durations are altered. New learning and categorization nets were shown to discriminate vowels with comparable accuracy but much higher compression than alternative methods. Models of skilled motor control were developed to clarify how speech and arm movements can be planned and flexibly modified by task requirements. Studies of neural oscillators suggest how rhythmic behaviors relevant to perception and action, notably synchronous oscillations, may be generated and controlled.

DESCRIPTORS: (U) \*AUDITORY SIGNALS, \*NEURAL NETS,

AD-A277 526

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DTIC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. T4P42J

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MATERIALS RESEARCH SOCIETY PITTSBURGH PA

\*ACOUSTIC SIGNALS, ACCURACY, ACOUSTIC FILTERS, COMPRESSION, INTERVALS, INVARIANCE, LEARNING, MODELS, OSCILLATION, OSCILLATORS, PARALLEL PROCESSING, PERCEPTION, REAL TIME, RECOGNITION, REQUIREMENTS, SIGNALS, SPEECH, STORAGE, TRANSIENTS, VARIABLES, VISION, AUDITORY PERCEPTION.

(U) Silicon-Based Optoelectronic Materials, Symposium Held in San Francisco, California on April 12-14, 1993. Materials Research Society Symposium Proceedings, Volume 298.

DESCRIPTIVE NOTE: Final rept. 15 Jun 93-14 Dec 93,

IDENTIFIERS: (U) PEB1102F, WUAFOSR2313AS.

DEC 93 478P

PERSONAL AUTHORS: Ballance, John

CONTRACT NO. F49620-93-1-0383

PROJECT NO. 2305

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0041, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Although silicon is at the heart of the microelectronics revolution, its low optical efficiency has limited its use in optoelectronic applications. The potential significance of combining communications and display technology with microelectronics technology has generated considerable activity directed at developing a silicon-compatible optoelectronic material. The last few years have seen some interesting and potentially important advances in this area. Symposium B was organized as a forum for the various groups studying the physics, materials science, processing and applications of silicon-based optoelectronic materials to present their most recent results in this rapidly growing field. Talks were organized into five basic areas: Si(1-x)Ge(x), rare earth-doped silicon (this session was organized jointly with symposium, E, Rare Earth Doped Semiconductors), silicon nanoparticles, porous silicon and applications. Many of the key research groups in each of these areas were represented at the meeting.

DESCRIPTORS: (U) \*OPTICAL MATERIALS, \*SILICON, \*COMPOSITE MATERIALS, \*ELECTRONICS, SYMPOSIA, SUPERLATTICES, CRYSTALS, QUANTUM WELLS, MICROELECTRONICS, GERMANIUM, RARE EARTH ELEMENTS, SEMICONDUCTORS, DOPING.

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POROUS MATERIALS, LIGHT, LUMINESCENCE, LIGHT EMITTING DIODES, VERY LARGE SCALE INTEGRATION, EMISSION, PHOTOLUMINESCENCE, ERBIUM, EPITAXIAL GROWTH, THIN FILMS.

MATERIALS RESEARCH SOCIETY PITTSBURGH PA

(U) Rare Earth Doped Semiconductors, Symposium Held in San Francisco, California on April 13-15, 1993. Materials Research Society Symposium Proceedings, Volume 301.

IDENTIFIERS: (U) WUAFOSR2305FS, Optoelectronic devices, Electroluminescent

DESCRIPTIVE NOTE: Final rept. 5 Feb 93-4 Feb 94,

FEB 94 432P

PERSONAL AUTHORS: Ballance, John

CONTRACT NO. F49620-93-1-0156

PROJECT NO. 2305

TASK NO. FS

MONITOR: AFOSR, XC  
TR-94-0042, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The properties of rare earth ions in solids have been studied in detail for decades, but until recently this work was restricted to dominantly ionic hosts such as fluorides and oxides, and to a lesser extent to more covalently bonded hosts, such as tetrahedral II-VI semiconductors. The idea of rare earth elements incorporated into covalent semiconductors such as GaAs and Si may be traced to a short communication in 1963 by R.L. Bell (J. Appl. Phys. 34, 1563 (1963)) proposing a dc-pumped rare earth laser. At about the same time, three unpublished technical reports appeared as a result of U.S. Department of Defense sponsored research in rare earth doped Si, GaAs, and InP to fabricate LEDs. Attempts by Lasher et al., Betz et al., and Richman et al. to identify sharp 4f specific emissions in these hosts essentially failed

DESCRIPTORS: (U) \*SEMICONDUCTORS, \*DOPING, \*RARE EARTH ELEMENTS, \*GALLIUM ARSENIDES, \*SILICON, EXCITATION, SYMPOSIA, IONS, SOLIDS, FLUORIDES, OXIDES, COVALENT BONDS, DIRECT CURRENT, PUMPING(ELECTRONICS), LASERS, INDIUM PHOSPHIDES, LIGHT EMITTING DIODES, GLASS, GROUP II COMPOUNDS, GROUP III COMPOUNDS, GROUP IV COMPOUNDS, GROUP V COMPOUNDS, GROUP VI COMPOUNDS, IMPURITIES, YTTERBIUM, KINETICS, THIN FILMS, LUMINESCENCE, ERBIUM.

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STANFORD UNIV CA DEPT OF MECHANICAL ENGINEERING

IDENTIFIERS: (U) WUAFOSR2305FS.

(U) Turbulent Reacting Flows and Supersonic Combustion.

DESCRIPTIVE NOTE: Final rept. 15 Feb 90-14 Oct 93

DEC 93 32P

PERSONAL AUTHORS: Bowman, C. T.; Hanson, R. K.; Mungal, M. G.; Reynolds, W. C.

CONTRACT NO. AFOSR-90-0151

PROJECT NO. 2308

TASK NO. BS

MONITOR: AFOSR, XC  
TR-94-0080, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) An experimental and computational investigation of supersonic combustion flows has been carried out. The principal objective of the research was to gain a more fundamental understanding of mixing and chemical reaction in supersonic flows. The research effort comprised three inter-related elements: (1) an experimental study of mixing and combustion in a supersonic plane mixing layer; (2) development of laser-induced fluorescence techniques for time-resolved multidimensional imaging of species concentration, temperature, velocity and pressure; and, (3) analyses and numerical simulations of compressible reacting flows. The specific objectives and results of the research of each of these program elements are summarized in this report. Supersonic combustion, Turbulent reacting flows, Shear layers, Laser diagnostics.

DESCRIPTORS: (U) \*SUPERSONIC COMBUSTION, \*SUPERSONIC FLOW, \*TURBULENT FLOW, CHEMICAL REACTIONS, CHEMICALS, COMBUSTION, GAIN, LASER INDUCED FLUORESCENCE, LASERS, LAYERS, MIXING, PRESSURE, TEMPERATURE, TIME, VELOCITY, AIR BREATHING ENGINES, STABILITY, COMPUTATIONS, MATHEMATICAL MODELS, COMPRESSIBLE FLOW.

IDENTIFIERS: (U) PE81102F, WUAFOSR2308BS.

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COLUMBIA UNIV NEW YORK LOWELL MEMORIAL LIBRARY

CALIFORNIA UNIV BERKELEY DEPT OF PHYSICS

(U) Ultrafast X-Ray Sources.

DESCRIPTIVE NOTE: Final rept. Aug 89-Aug 93,

AUG 93 125P

PERSONAL AUTHORS: Falcone, Roger W.

CONTRACT NO. AFOSR-89-0476

PROJECT NO. 2301

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0063, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) During the contract period we made progress in six areas: development of ultrashort pulse x-ray sources; generation of subpicosecond, unicycle electromagnetic pulses; propagation of intense short pulse lasers in plasmas; new x-ray lasers; new high-intensity, short pulse lasers; diagnosis of multiphoton ionized plasmas. Our work resulted in thirty-one publications, which are listed in Section III of this report. Publications not previously been sent to AFOSR are included in this report. Our work has resulted in forty-five conference presentations, which are listed in section IV of this report. Four additional invited talks are currently scheduled.

DESCRIPTORS: (U) \*ELECTROMAGNETIC PULSES, \*X RAY LASERS, \*X RAYS, \*PULSED LASERS, \*PHOTONICS, CONTRACTS, HIGH INTENSITY, LASERS, PULSES, SHORT PULSES, PLASMAS(PHYSICS), IONIZATION, X RAY SCATTERING, SYMPOSIA.

IDENTIFIERS: (U) WJAFOSR2301AS.

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DESCRIPTIVE NOTE: Interim rept.,

94 12P

PERSONAL AUTHORS: Ottaviani, M. F.; Bossmann, Stefan H.; Turro, Nicolas J.; Tomalia, Donald A.

CONTRACT NO. AFOSR-91-0340

PROJECT NO. 2303

TASK NO. B2

MONITOR: AFOSR, XC  
TR-94-0017, AFOSR

UNCLASSIFIED REPORT

Availability: Pub. in the Jnl. of the American Chemical Society, V116 n2 p661-671 1994. Available only to DTIC users. No copies furnished by NTIS.

ABSTRACT: (U) The structure of Cu(II) complexes formed with anionic starburst dendrimers (n.5 G-SBD) in aqueous solution has been investigated by the electron paramagnetic resonance (EPR) technique. The line shapes of the EPR spectra of the complexes at room temperature show a distinction between earlier (n 3) and later (n 3) generations and are consistent with a change of the dendrimer shape, which supports the results of molecular simulation of the dendrimer morphology as a function of generation. The earlier generations appear to possess amore open structure, which leads to a greater mobility of the copper complexes. Three different complexes of copper with groups composing the dendrimer structure are identified by analyzing the spectra as a function of the dendrimer size (generation), the pH, and the temperature. The magnetic parameters, evaluated at low temperature with the aid of spectral computation indicate that the copper ions form monomeric carboxylate complexes at low pH (signal C). With an increase of pH, the ions interact with nitrogen centers in the internal porous structure of the dendrimers. The complex formed at intermediate pH is

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identified as a Cu(II)-N30 or (Cu)-N202 complex (Signal A)

. Such a complex, which involves both the carboxylic groups at the dendrimer interface and the internal nitrogen centers, is preferentially formed by low generation dendrimers. Copper complexes; Starburst dendrimers; Electron paramagnetic resonance techniques.

DESCRIPTORS: (U) \*ELECTRON PARAMAGNETIC RESONANCE, \*NITROGEN, COMPUTATIONS, COPPER, ELECTRONS, FUNCTIONS, INTERFACES, INTERNAL, IONS, LOW TEMPERATURE, CARBOXYL RADICALS, MOBILITY, MORPHOLOGY, POROUS MATERIALS, MACROMOLECULES, REPRINTS, ROOM TEMPERATURE, SHAPE, SIGNALS, ANIONS, MOLECULAR PROPERTIES, SIMULATION, SPECTRA, STRUCTURES.

IDENTIFIERS: (U) PEB1102F, WUAFOSR230382, \*Starburst, \*Dendrimers, SBDS.

OHIO STATE UNIV COLUMBUS DEPT OF MATHEMATICS

(U) A Study of Weak Solutions and their Regularizations by Numerical Methods.

DESCRIPTIVE NOTE: Final rept. 1 Jul 92-30 Jun 93,

JUN 93 16P

PERSONAL AUTHORS: Majda, George

CONTRACT NO. AFOSR-91-0309

PROJECT NO. 2304

TASK NO. A3

MONITOR: AFOSR, XC  
TR-94-0065, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Consider the incompressible Euler equations with vortex sheet initial data. For this initial value problem, there are a number of outstanding conjectures: This initial value problem does not have a unique weak or measure-valued solution, a selection principle is required to pick out a unique solution. The limit of vanishing viscosity (in the Navier Stokes equations) provides the correct selection principle, and different regularizations, such as adding viscosity or smoothing the initial vortex sheet, may converge to different limits as the regularization tends to zero.

DESCRIPTORS: (U) \*EULER EQUATIONS, \*COMPUTATIONAL FLUID DYNAMICS, \*ELECTRON DENSITY, \*ELECTRON TRANSPORT, NAVIER STOKES EQUATIONS, NUMBERS, SELECTION, SHEETS, VALUE, VISCOSITY, SOLUTIONS(GENERAL), TWO DIMENSIONAL FLOW, PERTURBATIONS, INCOMPRESSIBLE FLOW, ONE DIMENSIONAL.

IDENTIFIERS: (U) WUAFOSR2304A3, \*Vortex sheets, Vlasov poisson equations, Electron sheets

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VIRGINIA UNIV CHARLOTTESVILLE

STRATEGY, SYMMETRY, TRANSFORMATIONS, COMPUTATIONS.

(U) Effective Computational Strategy for Predicting the Response of Complex Systems.

IDENTIFIERS: (U) WUAFOSR2302DS.

DESCRIPTIVE NOTE: Final rept. 30 Sep 90-31 Aug 93,

DEC 93 25P

PERSONAL AUTHORS: Noor, Ahmed K.

REPORT NO. UVA/525733/CEAM94/101

CONTRACT NO. AFOSR-90-0369

PROJECT NO. 2302

TASK NO. DS

MONITOR: AFOSR, XC  
TR-94-0096, AFOSR

UNCLASSIFIED REPORT

**ABSTRACT:** (U) An effective computational strategy is developed for generating the response of complex systems using (small or large) perturbations from the response of a simple structure (or a simpler mathematical/discrete model of the original structure). Two general approaches are developed for selecting the simpler model and establishing the relations between the original and simpler models. The two approaches are: decomposition or partitioning strategy, and hierarchical modeling strategy. Two effective partitioning strategies are used. The first is based on uncoupling of load-carrying mechanisms, and the second is based on symmetry transformations. The hierarchical modeling used is a predictor-corrector iterative process based on using a simple mathematical model in the predictor phase and correcting the response using a more accurate mathematical model. The strategies have been applied to several problems including: thermal buckling and postbuckling of multilayered composite plates; and nonlinear dynamic analysis of composite shells. Structure, Modeling, Buckling.

**DESCRIPTORS:** (U) \*MATHEMATICAL MODELS, \*SYSTEMS ANALYSIS, \*STRUCTURAL RESPONSE, APPROACH, BUCKLING, DECOMPOSITION, DYNAMICS, PERTURBATIONS, PHASE, PLATES, RESPONSE.

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AD-A277 430 8/11

HENRY KRUMB SCHOOL OF MINES NEW YORK ALDRIDGE LAB OF  
APPLIED GEOPHYSICS

model, \*Lg wave propagation, Uplifted Moho

(U) Finite-Element Modeling of the Blockage and Scattering  
of LG Propagation.

DESCRIPTIVE NOTE: Annual rept. 1 Dec 92-30 Nov 93,

NOV 93 58P

PERSONAL AUTHORS: Teng, Yu-chiung

CONTRACT NO. F49620-93-1-0073

PROJECT NO. 2309

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0099, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The problem of Lg wave blockage is being investigated using finite element models of island margin basin, and basin with an uplifted Moho to simulate wave propagation across the Barents Sea basin. Results from the first year follow. The efficiency of the crust as a Lg wave guide strongly depends on the frequency content of an impulsive source. The effects of a basin on Lg propagation also depends on the basin width and the velocity contrast between the sedimentary basin and the surrounding granitic/basaltic crust. For a high velocity contrast, the Lg wave form is significantly lengthened. The presence of an uplifted Moho alone does not appear to have a major blockage effect on Lg wave propagation. The finite element codes with the fast execution algorithm prove to be well suited as tools for the modeling purposes intended in this research.

DESCRIPTORS: (U) \*WAVE PROPAGATION, \*SEISMIC WAVES, \*SEISMIC DETECTION, \*MOHOROVIKIC DISCONTINUITY, ALGORITHMS, BARENTS SEA, EFFICIENCY, FREQUENCY, HIGH VELOCITY, MODELS, FINITE ELEMENT ANALYSIS, SEDIMENT TRANSPORT, COMPUTER AIDED DIAGNOSIS, UNDERGROUND EXPLOSIONS.

IDENTIFIERS: (U) PEG1102F, WUAFOSR2309AS, Island margin

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NORTH CAROLINA UNIV AT CHARLOTTE DEPT OF MATHEMATICS

(U) Conference on Operator Theory, Wavelet Theory and Control Theory.

DESCRIPTIVE NOTE: Final rept. 1 Apr-30 Sep 93,

SEP 93 19P

PERSONAL AUTHORS: Dai, Xingde

CONTRACT NO. F49620-93-1-0180

PROJECT NO. 2304

TASK NO. ES

MONITOR: AFOSR, XC  
TR-94-0089, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The conference on Interaction Between Operator Theory, Wavelet Theory and Control Theory, was held May 1-2, 1993 in Charlotte NC. The event was organized and hosted by the University of North Carolina at Charlotte. The main purpose of the conference was to bring researchers together, in so doing, to encourage an interchange of information and stimulation of cooperative efforts.

DESCRIPTORS: (U) \*CONTROL THEORY, \*INTERACTIONS, \*OPERATORS(MATHEMATICS), NORTH CAROLINA, UNIVERSITIES, INFORMATION EXCHANGE, SYMPOSIA.

IDENTIFIERS: (U) WUAFOSR2304ES, \*Wavelets.

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SEARCH CONTROL NO. T4P42J

AD-A277 428 3/2 20/3

HAWAII UNIV HONOLULU INST FOR ASTRONOMY

(U) Steps toward Understanding the Solar Dynamo.

DESCRIPTIVE NOTE: Final rept. 1 Feb 90-31 Jul 93,

JUL 93 17P

PERSONAL AUTHORS: LaBonte, Barry

CONTRACT NO. AFOSR-90-0116

PROJECT NO. 3484

TASK NO. HS

MONITOR: AFOSR, XC  
TR-94-0069, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The standard model of the solar dynamo, the mean-field models has numerous problems. Observational and theoretical tests of a new model of the solar dynamo, the fluxtube model, were needed to determine whether it might replace the standard model. Under this project we have made a variety of tests - that show the fluxtube model is better able to explain the observed properties of the magnetic fields on the Sun. During the course of this project, the deep involvement of students in the research and the upgrade of research facilities have improved the University's capabilities for providing technical education.

DESCRIPTORS: (U) \*MAGNETIC FIELDS, \*SUN, \*SOLAR DISTURBANCES, SOLAR ENERGY, ATMOSPHERIC SCATTERING, ACOUSTIC WAVES, SUNSPOTS, MAGNETIC RESONANCE, PHASE SHIFT, ABSORPTION SPECTRA, HIGH FREQUENCY, HEAT FLUX, EXPERIMENTAL DESIGN.

IDENTIFIERS: (U) PE61103D, WUAFOSR3484HS, \*Solar dynamo, Mean field model, Fluxtubes

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HAWAII UNIV HONOLULU DEPT OF PSYCHOLOGY

CONDUCTUS INC SUNNYVALE CA

(U) From Animals to Animals: Second International Conference on the Simulation of Adaptive Behaviour.

(U) YBCO Josephson Junction Arrays.

DESCRIPTIVE NOTE: Final rept. 30 Sep 92-29 Sep 93,  
JUL 93 29P

SEP 93 9P

PERSONAL AUTHORS: Simon, Randy

PERSONAL AUTHORS: Roitblat, Herbert L.

CONTRACT NO. F49620-92-C-0048

CONTRACT NO. F49620-92-J-0530

PROJECT NO. 1801

TASK NO. 2313

TASK NO. 07

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0075, AFOSRMONITOR: AFOSR, XC  
TR-94-0071, AFOSR

## UNCLASSIFIED REPORT

## UNCLASSIFIED REPORT

ABSTRACT: (U) This project provided partial support for an international conference on the simulation of adaptive behavior. The conference was held in Honolulu, HI on December 7-11, 1992. It was attended by more than 100 scientists from the US, Europe, and Asia. The main topic of the conference was how to use theories of animal behavior as a guide in the construction of robots and other autonomous agents. Contributors discussed how to develop behavior-based artificial intelligence, perception and motor control, action selection and the structuring of behavioral sequences, cognitive maps and internal world models, learning, evolution and adaptation, and collective behavior.

DESCRIPTORS: (U) \*ANIMALS, \*BEHAVIOR, \*PSYCHOPHYSIOLOGY, ADAPTATION, ARTIFICIAL INTELLIGENCE, ASIA, COGNITION, CONSTRUCTION, CONTROL, EUROPE, INTELLIGENCE, INTERNAL, INTERNATIONAL, LEARNING, MAPS, MODELS, MOTORS, PERCEPTION, ROBOTS, SCIENTISTS, SELECTION, SEQUENCES, SIMULATION.

IDENTIFIERS: (U) PE81102F, WUAFOSR2313CS, \*Adaptive behavior, \*Animal behavior.

ABSTRACT: (U) Josephson junction arrays have long been suggested as efficient, tunable sources for upper microwave and mm-wave frequencies. Based on the fundamental properties of the junction and the ability to combine the power output of many junctions using an array, the circuit concept is quite promising. The challenge is to phase lock the junctions so that power adds coherently and a number of demonstrations with Nb junction arrays have been performed doing this. This program was intended to begin using YBCO junction arrays to demonstrate source potential at 77K. Edge junctions have been used in arrays with up to 80000 junctions and the ability to couple power off-chip has been demonstrated directly for frequencies of at least 70-160 GHz. Power outputs have approached 1 micro W (in relatively narrow bands) and tunability has exceeded 20 GHz. Some novel array architectures have been built, including one with improved linewidth per unit junction, and new techniques developed for extracting junction statistics from array spectra. These techniques are used as feedback for process optimizations now in progress.

DESCRIPTORS: (U) \*ARRAYS, \*JOSEPHSON JUNCTIONS, \*YTTRIUM, \*BARIUM, \*COPPER, \*OXIDES, ARCHITECTURE, CIRCUITS, EDGES, FEEDBACK, FREQUENCY, JUNCTIONS, MICROWAVES, NUMBERS, OPTIMIZATION, OUTPUT, PHASE, POWER, SPECTRA, STATISTICS, MILLIMETER WAVES, NIOBIUM, PHASE LOCKED SYSTEMS.

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IDENTIFIERS: (U) WUAFOSR160107, \*YBCO(Yttrium Barium Copper Oxide).

SMITH-KETTLEWELL EYE RESEARCH INST SAN FRANCISCO CA

(U) Visual Processing of Object Velocity and Acceleration.  
DESCRIPTIVE NOTE: Annual technical rept. 18 Jan 93-15 Jan 94,

FEB 94 3P

PERSONAL AUTHORS: McKee, Suzanne

CONTRACT NO. F49620-92-J-0156

PROJECT NO. 2313

TASK NO. AS

MONITOR: AFOSR, XC  
TR-94-0102, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) Human observers can easily detect a signal dot moving, in apparent motion, on a trajectory embedded in a background of random-direction motion noise. A high detection rate is possible even though the spatial and temporal characteristics (step size and frame rate) of the signal are identical to the noise, making the signal indistinguishable from the noise on the basis of a single pair of frames. The success rate for detecting the signal dot was as high as 90% when the probability of mismatch from frame-to-frame, based on nearest neighbor matching was 0.3 control experiments showed that trajectory detection is not based on detecting a 'string' of collinear dots, i.e., a stationary position cue. Nor is a trajectory detected because produces stronger signals in independent 'local' motion detectors. For one thing, trajectory detection improves with increases in duration, up to 250 - 400 msec, a duration longer than the integration typically associated with a single motion detector. Moreover, the signal dot need not travel in a straight line to be detectable. The signal dot was as reliably detected when it changed its direction a small amount (<30 deg) each frame. Consistent with this, circular paths of sufficiently low curvature were as detectable as straight trajectories.

DESCRIPTORS: (U) \*NOISE, \*VISUAL PERCEPTION, \*VISUAL

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SIGNALS, BACKGROUND, CIRCULAR, CONTROL, CURVATURE, DETECTION, DETECTORS, FRAMES, HUMANS, INTEGRATION, MATCHING, MOTION, OBSERVERS, PATHS, PROBABILITY, RATES, STATIONARY, TRAJECTORIES, TRAVEL, MOVING TARGETS.

ILLINOIS UNIV AT URBANA DEPT OF PSYCHOLOGY

(U) Reminding-Based Learning.

DESCRIPTIVE NOTE: Annual technical rept. 21 Jan 93-20 Jan 94,

IDENTIFIERS: (U) PE81102F, WUAFOSR2313AS.

FEB 94 12P

PERSONAL AUTHORS: Ross, Brian H.

CONTRACT NO. AFOSR-89-0447

PROJECT NO. 2313

TASK NO. A4

MONITOR: AFOSR, XC  
TR-94-0126, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) When learning new cognitive skills involving problem solving, novices are often reminded of earlier problems. The use of earlier problems is a common means of problem solving and affects the learning of the skill. This project has three aims in understanding this learning. First, the representation of the resulting generalizations is being examined. Generalizations formed from reminders are likely to be conservative, in that they may be more tied to the examples than many current theories allow. A main aim of the project is to distinguish and test different forms of this conservatism. Second, the development of problem solving expertise is examined by focusing on differences in how typical and atypical problems are solved. Third, the effects of such reminding-based learning in everyday problem solving is examined to extend the findings and test some theoretical ideas that are difficult to investigate in more formal domains. This report provides an overview of this work and the progress on these objectives during the last year.

DESCRIPTORS: (U) \*COGNITION, \*PROBLEM SOLVING, FOCUSING, LEARNING, SKILLS, TEST AND EVALUATION, WORK.

IDENTIFIERS: (U) PE81102F, WUAFOSR2313A4.

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TEXAS UNIV MEDICAL SCHOOL AT HOUSTON DEPT OF NEUROBIOLOGY  
AND ANATOMY

(U) Analysis and Synthesis of Adaptive Neural Elements and  
Assembles.

DESCRIPTIVE NOTE: Final technical rept. 1 Oct 90-30 Sep  
93,

SEP 93 13P

PERSONAL AUTHORS: Byrne, John H.

CONTRACT NO. AFOSR-91-0027

PROJECT NO. 2312

TASK NO. A1

MONITOR: AFOSR, XC  
TR-94-0095, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) The overall objectives of this research were to investigate mechanisms underlying neural plasticity, learning and memory. Between October 1, 1990 and September 30, 1993, progress was made in eight areas: (1) Voltage-clamp experiments analyzed membrane currents in a neuron that is modified during learning. (2) These data were incorporated into a single-cell model of associative learning. (3) The single-cell model was incorporated into a small neural network and simulations examined the functions of interneurons and the consequences of plasticity at multiple sites. (4) Additional simulations with the single-cell model examined potential cellular mechanisms for operant conditioning. (5) As a first step toward identifying additional loci for learning-induced modifications, the synaptic interactions were characterized among neurons that function as a central pattern generator (CPG). (6) Experiments also characterized how transmitters modulated the properties of the neurons and synaptic connections in the CPG and altered the electrical activity in the CPG. (7) These data were used to develop a model of the CPG and simulations examined the mechanisms underlying the generation of rhythmic neural activity. (8) A realistic model of a bursting neuron was used to examine mechanisms

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underlying the generation and modulation of endogenous rhythmic neuronal activity. In addition, a computer program that is a general-purpose simulator for neural networks and action potentials was developed and has been made available to others. These results have provided general insights into information processing and storage in the nervous system. Learning, Memory, Information storage, Artificial intelligence

DESCRIPTORS: (U) \*LEARNING, \*NEURAL NETS, \*ARTIFICIAL INTELLIGENCE, \*MEMORY (PSYCHOLOGY), ADDITION, CELLS, CLAMPS, COMPUTER PROGRAMS, COMPUTERS, FUNCTIONS, GENERATORS, INFORMATION PROCESSING, INTERACTIONS, MEMBRANES, MODELS, MODIFICATION, MODULATION, NERVE CELLS, NERVOUS SYSTEM, NETWORKS, PATTERNS, PLASTIC PROPERTIES, SIMULATION, SIMULATORS, SITES, STORAGE, TRANSMITTERS, VOLTAGE.

IDENTIFIERS: (U) PE61102F, WUAFOSR2312A1.

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PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF  
METEOROLOGY

(U) Development and Testing of Improved Techniques for  
Modeling the Hydrologic Cycle in a Mesoscale Weather  
Prediction System.

DESCRIPTIVE NOTE: Annual rept. 15 Dec 92-14 Dec 93.

DEC 93 16P

PERSONAL AUTHORS: Warner, Thomas T.

CONTRACT NO. F49620-92-J-0118

PROJECT NO. 2310

TASK NO. CS

MONITOR: AFOSR, XC  
TR-94-0130, AFOSR

UNCLASSIFIED REPORT

ABSTRACT: (U) This research addresses the problem of moisture and temperature initializations in regional scale meteorological prediction models. Specifically, two approaches are used: one involving radar data and the second involving improved soil moisture content information. The model is initialized with rawinsonde data and then is forced to match convective signatures identified from WSR-57 radar data. Data from NOAA AVHRR radiometer data is used to initialize soil moisture information and generate large scale moisture fields. Methods of continuously updating soil moisture fields are under development.

DESCRIPTORS: (U) \*WEATHER FORECASTING, MODELS, MOISTURE, MOISTURE CONTENT, PREDICTIONS, RADAR, RADIOMETERS, RADIOSONDES, SIGNATURES, SOILS, TEMPERATURE, ATMOSPHERIC TEMPERATURE, HYDRAULIC MODELS, RAIN, ATMOSPHERE MODELS.

IDENTIFIERS: (U) PE61102F, WUAFOSR2310CS.

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